

The Promotion of Antral Repair, Drainage and
Aeration : A Clinical Study of the Local and General
Effects in Chronic Maxillary Sinusitis.

J. Morgenthal,

B.A., (Cape Town) M.B., Ch.B. (Edin.)

Edinburgh,

April, 1944.



The modern teaching of clinical medicine rightly emphasises the importance of beginning the examination of the Respiratory System by the examination of the nose and throat. The nose and its accessory sinuses, the naso-pharynx and the pharynx and its continuation as far as the rima glottidis form the upper respiratory tract, the lower respiratory tract comprising the subglottic portion of the larynx, the trachea, the bronchi and bronchioles. It is impressed upon the student that this wider view of the respiratory system is no mere anatomical concept, but one founded on the entire physiology of respiration. The nose forms the first line of defence of the air passages against whatever is harmful in the outside atmosphere, whether it be organisms, irritants or air that is too dry or too cold. Any factor that detracts from this function of the nose will open the way for disease of the lower respiratory tract.

The physician is therefore no less interested than the rhinologist in anything that pertains to altered nasal function and this is reflected in the number of medical cases sent for routine examination of the nose and sinuses in order to trace the etiological factor concerned in some lower respiratory disorder. The rhinologist, because of his special training, is able to make a more minute examination of the nose and treat any abnormality found by means of special methods not all of which are sur-

gical procedures in the strict sense of the term. That the work of both meet in this common field is also shown by the number of physicians that have trained themselves in the use of the bronchoscope and the naso-pharyngoscope, and with increasing knowledge and experience of the inter-relations of their work a boundary-line separating their fields of activity will become increasingly tenuous and ill-defined.

The normal nose has a most efficient defence mechanism against all agents, including bacteria, harmful to the respiratory tract. The inspired air is warmed to body temperature and saturated with moisture in its passage past the erectile tissue of the turbinates. As much as 1000 c.c. of water is supplied in this way by the nose in 24 hours. The air is also filtered. Experimental study (¹St. Clair Thomson) has shown how organisms, trapped in the layer of mucus and inactivated to a certain extent by its natural ferment "lysozone" are thereupon carried on in a stream created by the ciliary activity of the nasal mucosa to the naso-pharynx and thence to the pharynx. Hence after mixture with saliva they are removed by swallowing and destroyed by the acid of the stomach. Should, however, the organisms be very virulent or the general health depressed, or should there be stagnation caused by some physical factor in the nose, then the defence of mucus and cilia might be

overcome, and the organisms penetrate the epithelial layer and invade the submucous stroma. The toxic discharges produced complete the paralysis or destruction of the mucus-ciliary mechanism of the defence. The accessory sinuses are always involved with the nasal mucosa, but like it, the sinus mucosa in most instances overcomes the infection.

Inflammatory reaction takes place in the submucous stroma, white blood-cells and histiocytes overcome the invading organisms and the ostium that had been closed by inflammatory oedema opens again, and the normal ciliary function is restored. Should there be a deviation of the septum or a nasal polyp opposite the ostium the oedema around it may not subside in time to prevent a closed suppuration to take place in the sinus with resulting widespread destruction of mucosa and submucosa and even penetration of the infection to periosteum and bony wall of the sinus. The same could happen if the infection is particularly virulent or the general bodily resistance poor. Even if the ostium should open now the sinus lining may have been damaged beyond repair, and the sinus have become a suppurating focus from which bacteria-laden and toxic discharges pass into the nose and throat and from which toxic substances are absorbed via the lymphatics into the bloodstream.

Nature's method of overcoming or preventing such a closed suppuration in a rigid-walled space is

by ~~me~~ means of re-establishing its drainage and by an attempt to replace the damaged lining membrane. Drainage and aeration of the sinus cavity is also the guiding principle of the rhinologist in the treatment of sinus infection, whether he uses a medication such as Ephedrine to shrink the swollen ostial mucosa or whether he makes a substitute artificial drainage opening into the sinus. His ultimate aim is the restoration of a normally functioning ciliated mucosa. In many cases, however, the changes in the mucosa itself are so marked as to appear irreversible even should adequate drainage be provided. Here in addition the diseased mucosa would require to be removed.

This thesis represents the study of 70 cases in which such a procedure had been deemed necessary in the case of chronic disease of the maxillary antrum. The maxillary antrum particularly lends itself for study because it is the accessory sinus most frequently infected and because it allows of clear demonstration of the principles of treatment. Infection reaches it not only from the nasal cavity by way of its natural ostium but because of the close relationship of the roots of the pre-molar and molar teeth to its floor it can also be infected by disease of these teeth. Furthermore, the maxillary antrum is the only sinus constantly present in early childhood, at a time when such adverse factors as enlarged

tonsils and adenoids are most in evidence and when illnesses due to the infectious fevers are often complicated by a severe rhinitis. Many a case of chronic maxillary sinusitis dates back to an infection of the antrum - often unsuspected - at this time. For a long time even with established infection the antrum may remain the only sinus affected. Yet infection of the higher situated sinuses, the ethmoid and frontal sinuses, if not severe will in most cases resolve on its own accord, if the antral infection is treated in time.

It is not often that opportunity arises in rhinological practice to re-examine cases years after treatment to see not only how effective the particular treatment has been but also to judge how the treatment has reacted on the nasal cavity as a whole, on the throat and on the general health and well-being of the patient. Such a review is all the more of interest when it is remembered that one cannot touch the nasal structures without in some way altering normal nasal function. Structure and function are in very delicate balance. There is no redundancy and not much reserve. Treatment directed at one part may produce an undesirable and unphysiological result in an adjacent part, so that treatment must always be planned in accordance with the physiological precepts of the nose. The study is therefore not intended as one merely of the local results of a

particular operative procedure, but also of the way it had acted as a physiological procedure in restoring the nose as a functioning entity, or, where otherwise expectations ^{have} / not been fulfilled, an attempt is made to define what modification of the procedure would be more correct, or which other factors have to be taken into account. Furthermore the cases have been studied in the light of general medicine where instances have presented of remote complications of chronic antral infection.

The cases examined had been treated during the past 7 years in the Royal Infirmary, in the wards of Dr I. Simson Hall, who kindly afforded me facilities for their study, and who also allowed me to study four very instructive cases seen in his private practice. Requests for re-attendance for purpose of examination had been sent to all former patients who had had this operation and were living in or within reasonable distance of Edinburgh. Many could not attend but sent letters stating their present health. Only those that could personally be seen again were accepted as cases and they were unselected. Eleven of these cases had been treated by myself and their progress followed and recorded in their case-sheets.

The average time interval between operation and final examination was 2.9 years, the shortest interval being 1 month and the longest 6 years. Of

the seventy cases, 43 were females and 27 males. Both antra had been affected in 18 cases and in the remaining unilateral affections, the left antrum had required operation in 21 and the right antrum in 31 instances.

The average age of these patients at the time of operation had been 33.4 years, the lowest age being 13 and the highest 56 years. Almost half the number of cases fell into the age group of 25 to 40 years with about a $\frac{1}{4}$ being below this group, and a $\frac{1}{4}$ above it. Where indicated the particular age of the patient is no contra-indication except in the very old and infirm where a less radical procedure is advisable. At the other extreme of life the operation had been done on both sides in an infant of 21 months with satisfactory results and the eruption of all the permanent teeth later on ²(McArthur).

The changes produced in the antrum had in all cases been considered as to be irreversible. Clinically and radiologically these changes were associated either with a gross hypertrophic sinusitis with great thickening of the mucosa and often polypus formation in the antrum and the production of thick mucus or else with a suppurative sinusitis with much foul pus and often fibrosis of the periosteum and involvement of the bone.

Since the antrum cannot be obliterated and so eradicate the disease the aim of treatment had

been to promote drainage and re-establishment of a functioning antral lining. Drainage and aeration was obtained by making an artificial opening in the nasal wall of the antrum near its floor opposite the inferior meatus. The diseased lining is removed after gaining access to the cavity through an opening made in the thin bone of the canine fossa over its facial or antro-lateral wall.

The perfection of this method had not been reached until after several stages in its development had been tried and its history reflects the difficulties and the uncertainties of the early rhinologists in creating a physiological procedure.

As early as 1802 Desault conceived the idea of making an opening into the antrum through the canine fossa. This original method might early on have been developed by logical addition into something really effective. Unfortunately, however, until about the latter half of the eighties of last century only the dental origin of antral infection was recognised and consequently its treatment was almost entirely in the hands of dental surgeons who employed alveolar drainage after extraction of one or more diseased teeth. When the importance of antral infection from the nose was recognised and rhinologists started to treat the antrum, they adopted this method and followed it for a long time.

Kuster, however, in 1889 re-introduced the canine fossa method and it was soon (1894) improved upon by Jansen who in addition curetted away the diseased antral lining and thereafter made a flap from the mucous membrane of the cheek and this was packed on to the floor of the cavity. The canine fossa opening was held open by means of an obturator and local treatment directed through it. Boenninghaus (1897) thereupon added the additional feature of making an artificial communication between the antral and nasal cavities, preserving the nasal mucosa opposite the bony window and afterwards turning it, together with the middle third of the Inferior Turbinate, as a flap on to the floor of the antrum. The oral wound was allowed to remain open and entailed prolonged treatment of the antrum by local applications and often a bucco-antral fistula resulted. Hajek made the mucosal flap from the membrane lying below the level of attachment of the Inferior Turbinate. In 1893 Caldwell and Luc made use of the Boenninghaus method but the oral wound was closed by primary suture at the end of the operation and subsequent treatment directed through the nasal opening allowing the canine fossa opening to close and so prevent risk of re-infection from the mouth. They also used the Hajek mucosal flap. This was the method adopted in all the cases.

An outline of the operation must be given

and a few points stressed. Intra-tracheal oxygen and ether anaesthesia was employed with the intra-tracheal tube passed through the mouth, a post-nasal plug prevented blood or pus from the nose from running down the throat, and a thick swab placed between the jaws prevented blood from the buccal wound running down the throat. After the operation these packings are removed and the lower pharynx and the larynx inspected with the laryngoscope to make sure that there are no secretions that might be aspirated before the cough reflex is fully re-established. Pre-medication consists of $\frac{1}{100}$ gr. atropin-sulphate given by hypodermic injection. No morphia or other respiratory depressant is given. If it is suspected that in spite of these precautions excessive aspiration of secretions had taken place or if, because of a pulmonary condition present the patient had taken the anaesthetic badly and his respirations sound moist and 'bubbly' the bronchoscope may be introduced and the trachea and bronchi cleared with the aspirating tube. The physician therefore, may be relieved of a lot of his anxieties when advising this operation in cases of asthma and bronchiectasis.

An incision, curved downwards, is made above the gum in the mucosa of the gingivo-labial fold. It is about $1\frac{1}{2}$ inches in length and its anterior $\frac{1}{3}$ should cross the canine ridge. It is deepened through the periosteum to bone and the canine fossa

is exposed. Light retraction is made to the upper margin of the wound by means of a Hajek retractor. An opening is made into the antrum through the fossa of sufficient size (usually about the diameter of the little finger) to allow of the direct inspection by means of reflected light of all corners of the antrum. The antral lining is then curetted and swabbed and in doing so the mucosa with most of periosteum attached is removed and the bony wall is seen to be smooth and shiny. In several instances with thickened membrane but little pus present only the more grossly diseased portions were scraped. Particular attention is paid to the roof, junction of roof and medial wall, the floor and the inferior antro-medial angle where disease may escape attention. If need be the canine fossa opening is extended downwards and forwards somewhat so as to expose the Inferior Antro-medial angle. The antro-nasal bony wall below the level of attachment of the Inferior Turbinate is then removed so that a window is made that extends from well forward - from the posterior edge of the ascending frontal process of the maxilla backwards for a distance of about $\frac{1}{3}$ to $\frac{1}{2}$ of the nasal wall of the antrum. The mucosa opposite the window is then incised with a narrow sharp scalpel passed across the antrum, along the level of the top and side margins of the window and the flap thus formed is swung on its base into the antrum and laid against its floor.

Unless the Inferior Turbinate overhangs the naso-antral opening very much none of it is removed or at the most, removal should be restricted to a semilunar fringe from its lower edge opposite the opening. The muco-periosteal wound over the canine fossa is then closed with interrupted catgut sutures.

On the second morning after operation the antrum is washed out by means of a curved cannula introduced through the opening. This clears the cavity of blood-clot, fragments of mucosa etc. If no pus is present no further washouts are given; otherwise they are repeated daily until clear. The patient is usually allowed home on the 10th day after operation.

The antrum does not become dry at once even when no pus is present, but a slight discharge persists for a variable time necessitating the frequent use of the handkerchief. First serosanguineous it then becomes mucoid, gradually lessening until it ceases altogether in about 3 to 6 weeks time, to recur temporarily with each attack of coryza.

The Ultimate Fate of the Antral Cavity.

What eventually results inside the cavity after its muco-periosteum had been removed, was at one time an uncertainty. Even up to 1903 there was no certain knowledge of this matter and ³Tilley, seeking for an answer, had to satisfy himself with the surmise that the cavity probably became partially obliterated by granulation tissue arising from its bony walls,

uniting with that growing inward from the soft tissues of the cheek through the opening in the canine fossa. He furthermore surmised that complete obliteration of the cavity is only just prevented by epithelium growing in over the granulation tissue from the circumference of the naso-antral opening.

⁴Skillern writing in 1916 concerning the results after complete removal of the muco-periosteum states "that the cavity may become filled with fibrous tissue, which gradually becomes ossified." He recorded two cases where the antra were closed with spongy bone when re-opened several years afterwards for suspected recurrence of infection.

Instead of re-opening the antrum one has been able to make a visual inspection of the cavity by means of the Holmes' pattern naso-pharyngoscope. Using this as an antroscope the beak of the instrument was introduced into the antral cavity through the naso-antral opening and by moving its "eye" in different directions all corners of the cavity could be inspected under the illumination provided by the instrument. This was carried out whenever possible, but in a number of cases it was impracticable because of a septal deformity opposite the opening rendering the approach too narrow or because the patient was intolerant and inco-operative in spite of preliminary surface anaesthesia with cocaine.

Antroscopy :

Antroscopy:

In this way 37 of the seventy cases were examined. In none was there any marked alteration in the size and shape of the antral cavity. In one there was a firm ring-like thickening of the medial wall around the opening though the rest of the cavity was smooth.

The average time interval since operation was 2.9 years. In only seven was the interval below 1 year, so that the observations made would represent the permanent state reached. Indeed in six cases the time interval was 5 to 6 years and in another six, 4 to 5 years.

The Antral mucosa:

That the cavity should present such a normal shape and size after such long intervals would already suggest that a mucosal lining had reformed, otherwise granulations springing from bare bone and periosteum would have filled in the space and suppuration would have continued. But all had a definite mucosa, the general appearance of which was smooth, pale-pink and glistening. In about half the cases it was thin like the normal antral mucosa so that ridges and irregularities of the bony walls could be seen in relief, and in the other half it appeared thick and felt thick and soft on palpation with the end of the instrument. Its colour here also tended to be paler and even greyish.

Histological examination of this new membrane has shown that it really is a new mucosa resembling the normal antral mucosa very closely.

⁵Glatt in his study of the repair of the paranasal sinuses obtained specimens of this membrane by re-opening the antrum or by introducing punch forceps through the naso-antral opening and removing pieces of tissue. He concluded that a layer of granulation tissue forms on the walls over which columnar ciliated epithelium grew in, either from the margins of the natural ostium or from the edges of the antro-nasal opening and the edges of the mucosal flap if this had been made.

This had been noticed 8 weeks after complete removal of the old lining. The subepithelial mucous glands did not appear to regenerate. This process of repair had also been studied in an experimental way by

⁶Knowlton on the healthy antra of dogs and he was the first to prove in detail study how the cavity became entirely lined with a membrane the exact replica of that removed. This was complete after 5 months. A few months before Knowlton's experiments Tonndorf had reported on a case studied post-mortem 1 month after a radical antrum operation, and he noted that ciliated columnar epithelium had started to grow in from the antro-nasal opening over the layer of granulation tissue.

⁷Gorham and Bacher also studied the regeneration in the human antrum and concluded that complete regeneration took place of all the components of the mucosa

including the ciliated columnar epithelium, and that the period at which this occurs was approximately between 3 and 5 months and at the latest by 10 months.

The Correlation of Antroscopy with other Clinical Findings.

The regrowth of ciliated epithelium is very desirable as it protects the mucosa against re-infection. The optimum result after operation would therefore be a smooth-walled dry cavity. If abnormal secretions should be present, it would mean that either islets of the original diseased lining had been left at operation, or that a healthy regenerated lining had subsequently succumbed to re-infection from the nose. In the thirty-seven cases under discussion 7 showed abnormal secretions varying from streaks of muco-pus to pus in quantity. In 3 cases where pus was present there was an associated ethmoiditis in two of them, but in the third no nasal cause could be ascertained and it was probably due to incomplete removal of the old lining which at operation had been very badly diseased and suppurating. The remaining four cases showed muco-pus of which 1 was associated with ethmoiditis and in the remaining 3 the nose showed the presence of an allergic rhinitis. Against these 7 "moist" cases must be mentioned 3 cases showing clinical evidence of Ethmoiditis and 5 cases of Allergic rhinitis with recurrence of polypi, yet with the antrum completely dry. The antral mucosa in these cases,

however, appeared somewhat thicker and deeper in colour where Ethmoiditis was present, and thick and pale with associated allergic rhinitis.

The Antro-nasal Opening.

Its functions:

Its primary functions are those of drainage and aeration of the antrum. Thus the buccal wound may be sutured immediately and the canine fossa opening allowed to close and so eliminate added infection from the mouth. In the first few weeks after operation it drains away into the nose blood-clot, serum and debris thus preventing these collecting on the walls and encourage excessively thick granulation-tissue forming and obliterating the antral cavity. This is also prevented by the free access of air. In this way a suitable healthy bed is provided for the epithelium growing into the antrum from the nasal epithelium around the edges of the opening and from the edges of the mucosal flap, laid through the opening. In many instances the natural ostium had become permanently closed and fibrosed so that the artificial opening would furnish the only point of entry of the new ingrowth of epithelium.

⁸Glatt, in an experimental operation in, a case where the natural ostium was not patent and where no artificial one was provided found, when he re-opened the antrum 8 weeks after operation, that the antral walls were covered with a layer of thick hard fibrous tissue

with no evidence whatever of regeneration of epithelium.

At the end of 5 months when the cavity has received its new lining of columnar ciliated epithelium it could dispense with the artificial opening. As had been shown by Mygind, the cilia will ignore this opening and sweep the secretions against the force of gravity up the normal course to the natural ostium. Whether this normal method of drainage is sufficient depends not only on whether the ostium is patent, but also on the extent of the regeneration of the epithelium and on its functional activity. Both these factors are influenced adversely by residual infection present in the antrum or in the nose, so that the existence of an artificial opening would be a safeguard. Furthermore it is doubtful whether the regenerated epithelium ever possesses the same resistance to infection as that of the original, and is subject to re-infection especially if certain factors are present that favour infection of the nasal cavity, e.g., septal deviation, nasal polypi or residual infection of the higher sinuses. Should the opening become closed under such circumstances marked re-infection of the antrum would most likely follow with recurrence of symptoms and spread of the infection to the higher sinuses - the Ethmoid and Frontal sinuses - or progression of infection already present in them.

In 6 instances out of the seventy cases the antro-nasal opening had closed. Had this occurrence affected the subsequent progress of the patient at all adversely? The essential findings in each case are briefly given. (Full notes of all cases quoted are found in the Appendix).

Case 26. Patient had polypi in both nasal cavities and pus on the right side. Double Radical Antrum operation (Caldwell-Luc) done - In the left antrum - mucosa was thickened but otherwise fairly clear.

In the right antrum - cavity was full of polypi. Re-examined $4\frac{1}{3}$ years afterwards - patient still complained of frontal and occipital headaches.

The right opening was contracted but patent.

The left opening was completely closed.

Large firm polypus on the Left Middle Turbinate.

X-Ray Sinuses - The Ethmoidal and Sphenoidal sinuses are opaque on the left side. What had been clinically the less affected side was now the worse side on the side of the closed opening.

Case 32. A left Radical operation had been done on a fairly healthy antrum owing to a misleading X-ray picture and the right antrum - the real source of the suppuration, received only antrostomy drainage without removal of its diseased lining.

Re-examined $4\frac{1}{4}$ years afterwards it was

found that both openings had closed and that there was thick crusty discharge on both sides. Would permanent patency of the left opening have prevented such gross infection and have ensured a better outcome on this side ?

Cases 29 and 31 - had operation on one side, the other antrum being clinically healthy. Polypi and polyphoid mucosa were removed. There was no pus in the antrum and very little abnormal seen in the nose before operation. The trouble had been of short duration.

Re-examined 5 years later - in each case the opening had closed, but good results had been maintained all this time.

In addition to their being "early" cases it is to be noted that there were no adverse factors present in the nose such as badly deviated septum or an Ethmoiditis.

Case 55. Had been one of Atrophic rhinitis with crusting on the left side of the nose. The left antrum was opened and a counter opening made. A thin atrophic but otherwise normal membrane was not removed. Patient afterwards experienced and maintained marked general and local improvement. The crusty discharge became less and not so adherent and there was less dryness of the nose and throat. Headaches were relieved - no other treatment was used.

The additional aeration of the cavity though not permanent was sufficient to promote a better functioning mucosa and ostium.

Case 65. Operation done 4 months ago. An infected ethmoidal sinus was dealt with at the same time, but it is too early to judge the effects of closure of the opening. Also this has occurred only recently.

The antro-nasal openings have remained open so well that only these 6 cases were found and studied to determine whether any ill-effects followed their closure after the first 5 or 6 months or whether they served any useful purpose after that. Might it be desirable that they should close after rendering their primary service? It has been argued (Proceedings of the Royal Soc. of Medicine Feb. 5, 1932) that once the antrum and its ostium have returned to normal, such an opening might interfere with the suction drainage of the antrum, which is normally drained by ciliary action plus the effect of alternating negative and positive pressures in the cavity produced by the respiratory currents through the nose. An artificial opening at the other end of the antrum would interfere with the production of this negative suction pressure (2 to 8 mm. of water) during inspiration. But again there is no guarantee that the natural opening would become patent or remain so., since it is often closed by surrounding oedema in the middle meatus if such factors as septal deviations or nasal polypi be present.

The following series of cases, however, provides an argument for the desirability of the opening remaining patent in a nose that had required treatment. The opening was patent in all of these in contrast to the first group of cases discussed, but certain factors in the nose had recurred or had remained and could have prevented any benefit being derived from the operation.

Case 9. Double Radical Antrum operation and removal of Nasal Polypi.

The patient was re-examined $2\frac{3}{4}$ years later. The left nasal fossa was almost completely filled with large polypi leaving only a narrow airway along the floor of the nose, whilst on the right side the airway was much reduced by a badly deviated septum. The antral mucosa was thickened, pale and showed multiple slightly raised pale ridges.

There was no nasal discharge and patient was free of the former feeling of "heaviness in the head".

Case 50. Double Radical Antrum operation and removal of nasal polypi. Both antra contained polypi and foul-smelling pus.

Re-examined $3\frac{5}{6}$ years later there was recurrence of nasal polypi. Large polypi were seen both anteriorly and posteriorly in the nose. There was only slight mucopus present. The antral mucosa was thin

and smooth and showed no abnormal secretions.

The patient felt "clearer in the head" than before the operation.

It is felt that in these two cases aeration of the antra have kept the patients free of the distressing headaches and feeling of dulness usually complained of in cases of this type. The patients were pleased with the results.

Furthermore the formation of polypi in the antra had been prevented by aeration and drainage although the allergic factor, still active, had caused their recurrence in the nasal cavities.

In case 9 the appearance of the antral mucosa was suggestive of the usual allergic type. This was often seen in cases of active nasal allergy with recurrence of nasal polypi, but in no case had antral polypi recurred.

Cases 44 and 47 present similar features and it is also noted that the thick mucopurulent discharge had not recurred, as would have happened with non-aerated re-infected antra in which polypi had recurred.

Case 5. Antral suppuration complicated by Ethmoiditis.

This patient had a return of symptoms following closure of the antro-nasal opening and a second operation on the antrum was necessary.

At the first operation - Right radical operation was done and the "Ethmoid" opened.

Subsequently right-sided headaches became less marked and were even absent at one time, but shortly afterwards started again and increased in severity. The opening was found to be closing.

At the second operation on the antrum the opening was found to be almost completely closed and pus and polypi were present just around the inner aspect of the opening, the rest of the cavity being fairly clear. The ethmoid was not operated on again.

When re-examined $2\frac{1}{2}$ years after this second operation, the patient stated that her headaches and tendency to getting colds were much less marked than before. But there was clinical and X-ray evidence of marked Ethmoiditis (This was recently proved at operation).

The opening was widely patent and the antral mucosa was smooth and showed no abnormal secretion. This case seems to show well -

(a) relationship of closure of opening to increase in symptoms;
and (b) with good drainage the antrum has remained clear of polypi and free from infection, in spite of the long-standing infective focus provided by the Ethmoidal infection on the same side.

Case 8. The patient's headaches and frequent cold-catching relieved in spite of the presence (over 2 $\frac{5}{6}$

years) of frontal sinus and ethmoidal sinus involvement and a severe high deviation of the septum on that side.

Cases 19 and 27 similarly gave one the impression that the final result would have been less favourable if the openings should have closed.

It is felt that after its primary function of drainage and aeration of the antrum, when the antrum has sufficiently recovered the power of fulfilling these functions for itself, its closure does not adversely affect the health of the nose provided there are no adverse factors such as a deviation of the septum, an ethmoiditis or the existence of nasal allergy. These favour re-infection of the antrum which probably never fully recovers after longstanding suppuration, but is left with a susceptibility to infection. Furthermore, its closure often means that a complicating and associated ethmoiditis is made worse, and conversely, it has been shown how the symptoms of established ethmoiditis or nasal obstruction due to recurrence of polypi are not so severe where it has remained open.

The Size of the Antro-nasal Opening.

Whilst a very small opening could not be relied upon to serve its function at all times, could too large an opening prove equally disadvantageous? When a large opening is made most of the added size is obtained by extending it in a backward direction.

Troublesome bleeding may be met with and in a relatively small skull the making of a large opening might even result in injury to the descending palatine artery and the anterior palatine nerve in the pterygo-palatine canal.

As suction drainage plays an important part in emptying the antrum, the opening should not replace the greater part of the lateral wall of the inferior meatus. Instead of being removed secretions will undergo excessive drying with crusting on the edges of the opening and in the antrum. This will also be promoted if there has been too much removal of the anterior end of the Inferior Turbinate. The size of the opening should also be considered in relation to the width of the nasal passage anteriorly. If this is widened by marked deflection of the septum to the opposite side or if there is mucosal atrophy, the pressure of the inspiratory current of air will be diminished opposite the area of the opening. In such a case a smaller opening would have a better functional result.

These considerations are illustrated in Cases 23, 36 and 37. It was felt at the time of examination that a smaller opening might have given better drainage in case 23: In case 36 there were no apparent ill-effects and in case 37 a moderate opening seemed to be acting well in relationship with a large roomy nasal cavity. Though none of these

cases presented any real after-trouble, it would seem from the literature (Proceedings of the Roy. Soc. of Medicine June 7, 1929) that drying and crusting around the opening and in the antrum had been with some quite a troublesome feature of their cases. ⁹Barwell made the opening further back than usual to obviate the drying effect of the inspired air, but situated in a wider part of the Inferior Meatus, there would be corresponding loss of suction drainage.

Condition of the Total Number of Antro-nasal Openings examined.

Only 6 had closed of all the openings.

Each was in a different patient. The remaining cases had a total of 69 patent openings which could be classed as:

- (a) Patent with no contracture of margins - 44.
- (b) Patent but with margins contracted somewhat - 25

5 cases had openings patent on both sides but in each case they were of different sizes.

In 14 instances only, the openings had been in existence less than 1 year, the remainder being 1 year old or more viz :

8	had	been	in	existence	for	1	to	2	years.
21	"	"	"	"	"	2	-	4	years.
11	"	"	"	"	"	4	-	5	years.
10	"	"	"	"	"	5	-	6	years.

The Mucosal Flap.

This flap consisting of a roughly rectangular piece of mucoperiosteum of the lateral nasal wall

and made with a broad attachment, survives and plays a role in the history of the new-formed antral cavity. Watched with the antroscope it is seen to become swollen for the first few days after operation, afterwards thinning out, its base covering the raw lower margin of the bony opening and its extremity eventually merging with the granulations on the antral floor. As shown in the histological studies of ⁵Glatt, epithelial cells grow out from its edges and are extended as an advancing pellicle over the granulations. It forms an important and convenient focus of epithelialisation of the antral cavity.

A second and important role is in helping to prevent the closure of the antro-nasal opening. In its formation a window with clean cut edges is made through the mucoperiosteum. If the latter is simply broken through leaving ragged strips of mucoperiosteum projecting from the edges of the opening made, these soon tend to unite over the opening followed by the growth of new bone from the periosteum and obliteration of the opening. To overcome this disadvantage where a flap is not cut, a procedure such as galvano-cautery has been adopted in cutting out the window ¹⁰(Miller) or others try to overcome it by making an excessively large opening.

Apart from the presence of mucosal tags on its circumference the opening in the bone tends to close itself by granulation formation on its raw edges,

and particularly so in the case of its antero-inferior angle and inferior border where the bone is thick and more vascular. The thicker the bone here the heavier is the formation of granulations. This was well shown in case 65 where the bone at operation had been so thick that the use of a gouge was necessary to fashion out the Ant.-Inferior angle of the opening. Three months later, this angle was obliterated and in another month the whole opening had closed.

• In laying the flap across the raw inferior margin of the opening on to the floor of the antrum, its extremity is made to lie snugly in the ant. inf. corner of the antrum and in doing so the flap will also be stretched across and cover the rounded ant. inf. angle of the opening. In the usual case periosteum of flap will adhere to raw bone and the formation of granulations prevented. It serves a good purpose if it helps to maintain this extreme anterior part of the opening, for not only is any after-treatment to the antrum thereby facilitated but it also allows the antrum to communicate with the narrow anterior part of the nasal cavity where conditions for suction-drainage are most favourable.

In 5 cases an opening had been made by the above method on one side whilst on the other side the antrum was drained by the ordinary intranasal method of trephining the naso-antral wall and enlarging the opening by means of rasps and forward cutting Østrom's

forceps. After $3\frac{1}{2}$ years 4 of the former were adequately patent while only 1 intranasal opening was patent. The others had closed in spite of having been made 'large' as stated, and in spite of a drastic removal of the anterior end of the Inferior Turbinate.

The Effect on the Inferior Turbinate.

It has been thought by some that removal of the anterior end of the inferior turbinate might help in keeping the antro-nasal opening patent. It seems to have no such result. In 13 cases the Radical Antrum operation was associated with a marked turbinotomy of the ant. end of the Inferior turbinate so much so that after a period of years the loss of substance was still distinctly evident. Only in slightly less than half of these was the opening well patent ; in two it had closed, and in the rest it had contracted anteriorly. When a moderate turbinotomy had been done the results were not inferior. (In fact more than half the openings in these were well patent).

Unless there is a large and hard overhanging lower edge of the Inferior Turbinate none of its substance need be removed and certainly not its extreme anterior end unless grossly hypertrophied. It has been noticed how the Inferior Turbinate very often will become reduced in size after operation either because a chronic rhinitis has subsided, but more often probably as the result of trophic disturbances induced

by injury to its blood or nerve supply at its attachment, during removal of the naso-antral wall. This reduction in size will of course not occur if the hard hypertrophic change is present. Otherwise it does occur and may be noticed if the patient is seen at intervals after operation. Though not always recorded in the case notes one finds that Case 66 furnishes an illustration of this change. In the operation notes one had noted that a rather large inferior turbinate might need cautery later on, but nothing was done to it at the time. Two months later the turbinate had become reduced in size and the patient experienced an improved airway on that side.

Turbinotomy need therefore rarely be necessary in this method of antral drainage, and in this series of seventy cases it had been done in only 20 instances.

The anterior end of the inferior turbinate by virtue of its erectile tissue helps in warming and moistening the inspired air although not to the same degree as the middle turbinate. Yet its excessive removal might lead to crusting in the nose anteriorly and around the antro-nasal opening. It has, however, a more important function of directing and shaping the air-stream in its arched course up against the middle turbinate, on the course and force of this stream the ventilation and to a large extent the drainage of the accessory sinuses depends. How both of these conditions are adversely affected by removal of the anterior

part of the inferior turbinate, has been well shown in the experimental work of ¹¹ Scheideler. The arch of the current is lowered and its force reduced by stagnation of the air-current in the anterior part of the nasal cavity. This explains the sense of nasal obstruction sometimes experienced when there is marked mucosal atrophy and an apparently wide airway.

What ill-effects were noticed in these cases? 4 of the thirteen cases that had had a "large" anterior turbinotomy showed slight crusting, dryness and reddening of the middle turbinate on the same side, and there was no other cause to account for this. Nor was there mucosal atrophy apart from the loss of substance of the turbinate.

In 30% of these cases when a turbinotomy had been done a mucosal atrophy has been left as a legacy of the original disease-process. This fact forms an additional argument for removing as little of the turbinate as possible. Though not much adverse after-effect may be evident just now, such physical changes in the nose will in the end show the ill-effects of disturbance of related physiological function.

The Effects Obtained on the Local Disease.

The ultimate aim of the rhinologist is the total eradication of the antral disease, and the restoration of a normal functioning antrum, and the relief of all related nasal symptoms. Having achieved this he would also wish the desired result to be maintained indefinitely. Unfortunately many of these cases seen again after an average interval of 2.9 years had relapsed. Dan McKenzie (Proc. Royal Soc. Med. July 1932) referring to this disappointing feature remarked: "It seems that something essential about the pathology of sinus suppuration was not understood, for in spite of a perfectly planned and executed operation, a large percentage of cases continued to suppurate, and this without there being infection of other sinuses or that operation on them did not help." He then referred to such possible causal factors as allergy and avitaminosis.

The answer is to be found not in something inherent and abstruse in sinus pathology but in the presence of certain adverse factors in the nose principally, but also in the patient's general health. Nasal conditions may take the form of disease in other parts of the nose, of the presence of the allergic state of the mucosa, or of abnormalities either developmental or the result and legacy of long-standing nasal disease. General factors ~~are~~ are such as poor general health giving poor resistance to infection,

unsuitable surroundings at work and lack of sufficient rest, fresh air and exercise.

It was shown, when dealing with the antrum and antro-nasal opening, how it is attempted to restore the antrum and its function by methods calculated to disturb the general physiological function of the nose as little as possible. These methods would in most cases prove highly and permanently successful if the antral disease had been the only consideration. There would have been little need to continue such a study further. But in the face of the non-obtainment of uniformly successful results the study has to envisage the entire clinical picture presented by the patient. This seemed to be the best method of approach in elucidating the presence and action of adverse nasal factors. ¹² Stahl et al. obtained confusing results when they studied the antral condition apart from the general clinical condition. Judging by a clear antral wash they obtained 54% cures, but when the entire clinical results were also considered only 24% of cases were "successful" and 28% "improved".

The condition of the antrum was determined both by antroscopic examination, where this could be carried out, and by antral wash-out to determine the presence of abnormal secretions. A complete clinical examination of the nose has to follow for in many instances a good antral result has been obtained with relief of certain symptoms yet related disease may

still be present in the nose, or again the antrum may be dry yet pus be found high up in the nose. This would explain the anomalous findings of Stahl et al.

The optimum criterion would be a case free of symptoms, presenting a dry healthy antrum, and showing no abnormal secretions in the nose. The detailed study of any case falling short of this standard should reveal which adverse factors had prevented it reaching that standard and their action and influence. The cases approximating this rigorous standard the closest were considered as "cured" and after detailed study of the rest it seemed desirable to divide them into descending grades of "much improved", "somewhat improved", and "not improved or failures", as by doing so most information would be given by the statistical study involved.,

The following were obtained :-

- I. "Cured" 32 (45.7%)
- II. Much improved 15 (21.4%)
- III. Somewhat improved 10 (14.3%)
- IV. Not improved 13 (18.6%).

A statistical analysis was then made of each group. Using Group I. as an example this is given in detail here to show the method used.

e.g. Group I. "Cured" - 32 cases.

The Clinical Findings before Operation :

Symptomatology.

The number of cases where a particular symptom was present is shown under the different headings:-

Nasal Dis-charge.	Obstruction.	Colds	Headaches	Loss of sense of Smell.
(10 severe 22 (9 moderate (3 slight (Post-nasal	19	11	(3 severe 14) (11 moderate	5

Cacosmia	Bad taste in mouth	Dryness of Nose
1	2	1

Rhinoscopic: Pus was present in the nose in 19 cases:

Examination:-
In large amount 6
In moderate " 13

The antral condition at operation :

Chronic suppurative sinusitis 17 cases (53.1%) of total
"cured"

Chronic hyperplastic sinusitis associated with nasal allergy 5 " (15.6%)

Suppurative sinusitis due to dental infection 6 " (18.8%)

Antro-choanal polypus 4 " (12.5%)

In every case the antrum had contained either pus or polypi or both.

There was bilateral infection in 8 cases (25% of Total
"Cured")

unilateral " " 24 " (75% " "

The average duration of the disease before treatment:

2.4 years.

Cases with duration below 1 year -- 8 25% of
total cured.

The Clinical Findings (Post Operative) presented now;

In all the 32 cases, there was no pus in the nose, the antra were dry and all the major symptoms were relieved. In the case of sense of smell, this had returned fully in 2, partially returned in 2, but remained lost in 1.

Minor symptoms were present in 12 cases, but on closer study the symptoms were considered unrelated to the original condition and so mild as not to detract from, or influence the clinical result and grading of the cases.

In the following groups, however, residual symptoms bore an important relation to the clinical result obtained and their analysis gave useful information. The method of analysis used is illustrated by an analysis of the symptoms in this Group I.

4 had slight post nasal discharge.	1 Deviated septum and enlarged post. ends of Inf. Turbinates. 1 Enlarged Post. ends. 2 No cause found.
1 Post nasal discharge & slight headache.	Deviated septum & enlarged Inf. Turbinates.
1 Post-nasal discharge slight nasal obstruction and colds.	Deviated septum.
5 Slight headaches.	1 Due to an occipital fibrositis which was receiving massage treatment. 1 Septic tonsils and poor general health. 1 Bad surroundings at work. 2 No cause found.

The other groups were studied in a similar way and using the same steps in the analysis in an endeavour to determine why their results should fall short of those of the first group and in an increasing degree until the "not improved" classification has to be given. Which factors determine a poorer result ? The length of time the infection had existed before treatment might be considered since the more established the disease the more difficult it might be to eradicate and the more secondary changes it would have produced in the nose. Similarly a bilateral condition might imply a severer and more deeply-seated infection and a suppurative type of sinusitis might mean the same. What additional factors suggest themselves:-

	I. Cured	II. Much Improved	III. Somewhat Improved	IV. Not Improved
Type of Chronic Sinusitis :				
Chronic suppurative	53.1%	60%	70%	53.8%
Chronic hyperplastic-"allergic"	15.6%	33.3%	20%	46.2%
Antro-Choanal polypus	12.5%	6.6%	-	-
Dental Infection	18.8%	-	10%	-
Bilateral Infection	25%	26.6%	30%	53.8%
Single "	75%	73.3%	70%	46.2%
Average duration of disease before treatment in years.	2.4	1.8	2.8	2.9

	I.	II.	III.	IV.
	Cured	Much Improved	Somewhat Improved	Not Improved
Percentage of each group where condition has been present less than 1 yr.	25%	33.3%	50%	30.8%
Deviated septum & Hypertrophic rhinitis	12.5%	40%	10%	7.7%
Nasal allergy & Polypoidal Turbinates	-	20%	10%	-
Nasal allergy & Recurrence of Polypi	-	13.3%	10%	30.8%
Ethmoidal (and Sphenoidal) Infection	-	6.7%	50%	69.3%
Imperfect Operation.	-	-	-	15.4%
Poor General Health.	3.1%	13.3%	-	-
Bad surroundings at work.	3.1%	-	-	-
Antro-nasal opening closed	-	6.7%	-	-
Antro-nasal opening too large			10%	
No cause found	12.4%	-	10%	-

Conclusions drawn from this Table:-

With regard to — Type of Sinusitis.

Chronic suppurative sinusitis does not seem to have any influence in determining the ultimate result obtained but the hyperplastic-"allergic" type conduces to a poor end-result.

Dental infection and antro-choanal polypus respond well to treatment. In fact 6 out of the seven cases of the former and 4 out of the five cases of the latter were completely 'cured'.

Average Duration of Condition before Treatment.

There is so little difference that the age of the disease process does not seem to have any influence. In fact it is noted that the better groups I. and II. have a smaller percentage of fairly recent cases than the worse groups. One would have expected the converse.

Bilateral or Single Disease of the Antrum.

There is definitely a rising percentage of bilateral cases as the classification worsens; until in the not improved group there are almost as many bilateral as single affections of the antrum.

Deviated Septum and Hypertrophic Rhinitis.

The effect of these factors has already been shown in detail in the first group where it was minimal. In Group II., however, they are more than thrice as

prominent and their effect as studied in the cases in this group were certainly not minimal, but contributed towards a somewhat poorer result being obtained. Their large percentage here suggests that they needed treatment, and since they respond well, further operative treatment such as submucous resection of the septum and turbinotomy might have improved a good many of these cases still further. Their effect in the worse groups appears to be small.

Nasal Allergy and Recurrence of Polypi.

This factor definitely predisposes towards a poorer end result, and forms the second most important adverse factor in the nose. It will be considered in greater detail.

Ethmoidal (and Sphenoidal) Infection.

This is shown to be the foremost adverse factor causing an increasingly poorer end-result as its percentage rises from the second to the fourth group, and in the worse groups it overshadows all the other factors. It will be considered in greater detail.

Chronic hyperplastic sinusitis associated with Nasal Allergy.

Altogether 14 cases (20% of total cases) presented this feature. 4 cases responded well to treatment and the nasal and antral conditions were cured: The others gave poorer end-results. Are

Are there any features in a given case that are of prognostic significance:-

	I.	II.	III.	IV.
	Cured	Much Improved	Somewhat Improved	Not Improved
Percentage of total number of Allergic cases.	28.6%	28.6%	14.3%	28.6%
Average duration before treatment in years	2	3.3	1.1	3
Associated nasal condition <u>before</u> treatment:				
Allergic mucosa	75%	-	-	-
Mucous polypi	25%	100%	100%	100%
Associated nasal condition <u>after</u> treatment:				
Allergic mucosa	none	25%	50%	-
Polypoidal oedematous Turbinates	none	50%	-	-
Recurrence of polypi	none	25%	50%	100%
Presence of Deviated Septum and hypertrophies	25%	25%	100%	75%
Abnormal secretion in Nose	none	75%	50%	100%
Abnormal secretion in Antrum	none	50%	50%	25%

It is seen that whilst the duration of the condition before treatment does not seem to have any bearing on the ultimate result, the nature of the associated nasal allergic condition does have such.

If merely an allergic pale oedematous mucosa is present and the condition had not progressed to actual polypus formation the result of treatment is much better. In the 'cured' cases 75% had not progressed to polypus formation. In all cases the antral mucosa was polypoidal.

In half the number of cured allergic cases the allergic nature of the mucosa was also evident in the histological examination: One case was associated with asthma. In the other half, in addition to the presence of a typical allergic nasal mucosa, the patients suffered from attacks of sneezing, nasal obstruction and running of the nose. After removal of the polypoidal antral mucosa and the establishment of free drainage these symptoms disappeared altogether. It would almost appear that the antrum formed a reservoir for some endogenous allergic principle excreted into it. When seen again 6 months later these symptoms were still absent and in place of the typical allergic mucosa generalised mucosal atrophy was present. (e.g. Case, 66). Does the mucosa if it should become free of the allergic reaction, heal itself by means of a fine fibrosis which leads to atrophy ? In this connection it is also interesting to refer to

to case 55. Clinically this had been one of atrophic rhinitis with crusting in the nose and an opaque left antrum. The antral mucosa was atrophic but otherwise normal. Free drainage was provided and much improvement followed with less crusting and dryness of the nose and less headaches. The histological examination of specimens of antral and nasal mucosa showed "enough eosinophilia to warrant a diagnosis of allergic rhinitis". Histological findings taken as sole evidence are unreliable in the diagnosis of allergic mucosal reaction and often contradict overwhelming clinical evidence in favour of labelling a condition allergic. Yet when such a mild atrophic rhinitis is met with that is not the result of previous gross nasal suppuration but of some other cause - often considered as "constitutional" - one might speculate as to whether the mucosal atrophy had not originally followed on a "healed" allergic condition. Nasal allergy is quite common in early adult life, and whereas if long continued it often gives rise to mucosal hypertrophy, it might if it subsides fairly soon, provide a cause for many cases of atrophic rhinitis seen in later years.

Considering the less successful groups of cases it is apparent that nasal polypi tend to recur in such cases where they had already been present before operation and furthermore, that the more they do so, the poorer the end result obtained.

That they should recur is of course in the first instance due to the active allergic

diathesis persisting in the nasal mucosa; but an explanation is also found in the difficulty of removing all the smallest tags, and in the irregular fibrosis which follows on the old site, or in the degree of osteitis already present. Yet another factor - septal deformity and hypertrophies - is seen to be closely associated with their recurrence. Obstructed airway definitely favours recurrence as is seen in many cases where recurrence has taken place in the narrow side only, whereas previously polypi had been removed from both sides.

The recurrence of polypi favour the recurrence of nasal discharge and obstruction according to the degree of recurrence, but there is not the same concurrent relationship in the case of secretions in the antrum. This may appear paradoxical, but it is found that with good drainage and aeration the antrum is not affected again or only slightly so. In many cases with recurrence of polypi and nasal secretion it is seen to be dry, and antral polypi have certainly never recurred. Furthermore, as has been shown before, and contrary to what one would have expected, the same headaches do not recur again.

Nevertheless many patients are worried and disappointed when polypi and discharge recur, though many, free of headaches and "dulness" of the head, are well pleased with the result.

To ensure better end-results one method, in the usual run of cases, would be to treat septal deformities and hypertrophies. In cases not showing much related nasal allergic changes but with the antral mucosa thickened and polypoidal and with pus perhaps present, the removal of the diseased antral mucosa and the establishment of drainage should ensure a larger proportion of 'cured' cases. If postponed unduly the disease will give rise to polypi in the nose and it would be correspondingly difficult to obtain such a good end result. Clinical study with repeated X-ray study of the antrum with or without the use of lipiodal injection as an adjunct, should, of course, exclude beforehand the antral changes being due to an acute allergic reaction in its mucosa.

Even with no polypi present in the nose the type of case under consideration here would prove to be too inveterate for ionisation therapy to produce much effect.

In all these cases though, whether 'early' or 'late', some form of general treatment could be directed against the allergic diathesis; and here the physician might help in studying the patient's type and constitution and look for such contributing factors as anaemia, errors of diet, gastro-hepato-intestinal insufficiency, want of fresh air and exercise, and poor climatic conditions.

If general treatment also should not help in preventing recurrence^{of} polypi and their repeated removal is demanded, the degenerate allergic mucosa could be directly attacked by means of radium application to the upper lateral wall of the nose. If necrotic ethmoidal bone should be present this requires removal in addition.

13 Formby described a method of giving a dose of 546 mgm. hours.

Residual Ethmoiditis (and Sphenoiditis) as an Adverse Factor.

It was noted how this factor overshadowed all the others in tending to give a poorer end-result. Absent in the "cured" group it is present in a minute percentage in group II., but then there is an immediate increase so that it forms half the total factors responsible in the third group and about 70% of those in the "not improved" group. It is not only the most important factor to consider when one wishes to avoid disappointment after antral drainage but it also assumes a much more sinister aspect in the Post-operative history of the case than any of the other residual factors.

In the immediate post-operative history of the case it is often responsible if a severe complication should occur. Its importance in producing severe complications after frontal sinus surgery if left untreated or unrecognised is well known. In the case

of surgery of the maxillary antrum Logan Turner (Proc. Roy. Soc. Med. July 5 1932) found that there was associated ethmoidal infection in 13 out of the 14 cases with severe complication. The most common complication was an acute diffuse osteomyelitis of the maxilla. The Caldwell-Luc and the intranasal methods of operation were about equally represented.

Whilst no complications followed in any of these cases it will be seen from the following table that residual ethmoidal infection tends, the poorer the end-result, to be associated with headache, discharge and remote symptoms of toxic origin. The headache, unlike the mild type associated with recurrence of polypi and nasal obstruction, is of a severe worrying type and experienced as pain behind the eyes or referred to the vertex, occiput or mastoid regions. One case had severe peripheral neuritis and tachycardia which immediately disappeared after treatment of the ethmoid at a subsequent operation. The nasal discharge was more definitely purulent and in the worse groups, Post-nasal discharge was very evident and gave rise to much post-nasal crusting, irritation and discomfort. It also caused a degree of granular pharyngitis in some cases and in one case there was an atrophic pharyngitis present. Reddening of the vocal cords and of the arytenoids were present in all these cases of post-nasal discharge. The character of the nasal discharge appeared in marked contrast to that of the

allergic group where it was invariably muco-purulent only and often quite scanty in amount. There was also a higher percentage of associated abnormal secretion in the antrum and this was in addition also more often purulent.

Including those cases successfully dealt with at the time of the operation, a total of 17 cases (24.3% of complete total) were met with where there was clinical and X-ray evidence of ethmoidal infection complicating the antral infection. Excluding these three cases 14 (or 20% of all the cases) remained with active ethmoidal infection acting as an adverse - residual factor in giving poorer end-results to the treatment of the antral condition. In two of these there was accompanying sphenoidal infection and in one a definite frontal sinus infection. Infection of the Ethmoid (and Sphenoid) was diagnosed at the time of re-examination by the clinical examination of the patient supported by definite X-ray evidence in three cases and verified at subsequent operation on the ethmoid in three cases.

Table /

Table of Ethmoiditis as the Adverse Factor:-

	I. "Cured"	II. Much Improved	III. Somewhat Improved	IV. Not Improved
Average duration of patients' trouble before treatment	3.7	2.5	4.9	3.1
(For comparison. Average duration for all cases before Treatment)	2.4	1.8	2.8	2.9
Average percentage of each group where condition had been present less than 1 yr.	none	none	40%	33.3%
Bilateral antral disease	66.6%	66.6%	20%	83.3%
Unilateral "	33.3%	33.3%	80%	16.7%
Ethmoidal infection - dealt with at operation on antrum	100%	66.6%	--	--
Local condition of nose before operation - Polypi in nose	100%	66.6%	80%	50%
Presence of deviated septum and hypertrophies	33.3%	--	40%	16.7%
Abnormal secretions in nose: Mucopus Pus	-- --	66.6% 33.3%	-- 80%	33.3% 66.6%
Abnormal secretions in antrum Mucopus Pus	-- --	66.6% 33.3%	-- 40%	33.3% 16.7%
Symptoms left: Discharge (Toxic) Post-nasal Discharge Headaches and remote toxic affections	-- -- --	33.3% -- 33.3%	40% 20% 60%	50% 33.3% --

What type of case is likely to be associated with residual Ethmoidal Infection ?

The duration of the patient's trouble before treatment:

It is noted from the foregoing table that the average duration in cases with ethmoidal infection is, when compared with that of all the cases taken together, somewhat higher and this is especially so for the poorer groups. It is also notably higher when compared with that of the allergic cases. One would expect that the longer the history of the case the more likely the possibility of infection having occurred in the ethmoid. Nevertheless a fair percentage of cases of below 1 year's duration belonged entirely to the poor groups III. and IV., the better groups I. and II. having none of a duration less than 1 year. Yet in the latter where high proportions of ethmoid infection were dealt with at the time of the antral operation, the infection proved amenable to treatment and the results fell within these two good groups. Examples of cases with ethmoidal infection dealt with at the time of the antral operation and resulting in "cured" and "much improved" results are cases 57 and 65 respectively.

The presence of deviated septum and hypertrophies is not nearly such a predisposing factor in the development or continuation of the ethmoiditis as it was shown to be in the case of recurrence of polypi. It is also least in evidence in the worst group so that



here other etiological factors e.g. virulent initial infection of the nose and sinuses, may have been responsible.

It is noted what a high percentage (70.6) of these cases were associated with nasal polypi before operation. These were, in fact, cases of long-standing allergic rhinitis with polypi-formation. They were not included under that group since the presence of the severer ethmoidal infection has given them a different aspect. As distinct from the superficial osteitis often present in many cases of polypi, the ethmoidal bone in cases where the ethmoid was operated on was in addition soft, necrotic, and contained pus instead of merely polypoidal tissue. It is also noted that a high percentage of such cases were dealt with at operation with good results. The poorest class of case had the smallest percentage of polypi present. Cases of this class were either due to straightforward ethmoidal infection or else the absence of polypi in the ethmoidal region tended towards its being overlooked at operation.

It is desirable that not only the antral infection but infection from such an important source as the ethmoid (and sphenoid) be treated at the same time; at the same time drainage will be provided by the frontal sinus. If this is done there should be less risk of immediate post-operative complications, and of the antrum getting re-infected, and more chance of an ultimate cure or good result. ¹²Stahl et al. already

quoted, noted that in cases of bilateral antral infection with co-existing ethmoidal infection, the results of antral surgery were definitely better on the side where the ethmoid also received attention.

The method of dealing with the ethmoidal infection at the time of operation may help to account for a proportion of the cases with residual infection. Whatever the method chosen surgery of the ethmoid is fraught with difficulties.

The intranasal approach means working with monocular vision in a very restricted field, and a very vascular field made worse by the usual ether anaesthesia. These difficulties are increased if a deviation of the septum to that side is present at the same time. Because of the high infectivity of the secretions in these cases, such a deviation, especially in bilateral cases, cannot with safety be dealt with by submucous resection at or before operation. ¹⁹ Watson-Williams, in such a case, attempts the infraction of the septum to the opposite side by means of a Killian speculum. There should be very little loss of substance of the middle turbinate otherwise a poor functional result follows. Great care must constantly be exercised not to encroach upon Burger's dangerous area and the cribriform plate. In a case with much bleeding all these considerations may mean a great lengthening of the usual time for the antral operation and yet give unsatisfactory eradication of the infection.

Alternative methods would be the promotion of a clearer operative field. Local anaesthesia, including surface anaesthesia and nerve blocking, produces this to a greater extent. Both the antrum and the ethmoid could be dealt with at the same time, though this method, especially as far as the antrum is concerned, would find the greater majority of patients not sufficiently tolerant. But the ethmoid could be dealt with, using local anaesthesia, some weeks before the antral operation done under the usual general anaesthesia. ¹⁵ Warner and McGregor "on no account" do the ethmoidal at the same time as the antral operation. The use of the newer anaesthetics e.g. cyclopropane, & trilene or the use of ether in the "closed circuit" type of anaesthetic apparatus might perhaps help to alleviate one aspect of the matter - the difficulties caused by the bleeding.

Yet another method may allow of both antrum and ethmoid being dealt with at one and the same operation and using the usual safe ether anaesthesia but minimising many of the difficulties discussed. This is the transantral method of approach to the ethmoid. Originally suggested by Boenninghaus (1913) for opening the sphenoidal sinus and post. ethmoid, and used by Jansen, it was reviewed by ¹⁶ Horgan who claims many advantages for it in dealing with the whole ethmoid and sphenoidal sinus if necessary. In this method use is

made anatomically of the very obtuse angle - looking upwards and outwards - which the roof of the antrum and lamina papyracea make with each other. This allows an instrument introduced across the antrum to its post. sup. medial angle, to enter through the post. medial part of the orbital surface of the maxilla into the ethmoidal body which this surface helps to enclose. This entry is thereafter enlarged in a backward and a forward direction as desired. It is claimed that bleeding is more readily controlled and the manipulations can be better visualised - often with binocular vision - and that they depend less on the tactile sense alone. Furthermore that manipulations can be done with greater safety and by permitting the preservation of the whole of the middle turbinate a better functional result is obtained. The whole operation, on antrum and ethmoid, does not occupy a shorter time than the usual method of operation but a better result is claimed for the ethmoidal part.

The canine fossa access to the antrum and deleterious involvement of the blood and nerve-supply of the upper teeth.

It is pointed out by ¹⁷Ivy that the anastomosis between the dental vessels is so free that nothing short of dividing the vessel just as it enters the apex of the root would affect the vitality of the tooth. It is to interference with the nerve-supply of the

teeth that we must look for altered sensation in the teeth. ¹⁸ Myers points out that in the case of the upper jaw the nerve supply does not lie in close proximity to the roots but descends to them from some distance higher up in bony canals in the anterior wall of the antrum. Removal of a portion of the bony wall will therefore mean the interruption of a certain number of these fibres. When the opening is made over the canine fossa the fibres of the anterior sup. alveolar nerve supplying the incisors and canine teeth on that side are interrupted. If the bony opening is made just sufficiently large to allow of inspection of all the corners of the antrum and is not extended downwards into the alveolus proper and so approach the roots directly, the interference with the dental nerve supply is restricted to that of the incisors and canine teeth and in these it can also be made minimal. In this respect the recommendation of Mollison (Proc. Roy. Soc. of Med. Feb. 6 1932) that the opening should be made triangular in shape with the apex pointing downwards, might still further minimise the extent of the trauma to the descending nerve fibres. If the Denker modification of the operation is adopted a more extensive damage is to be expected.

Interference with the nerve-supply leads to a degree of numbness of the tooth and loss of vitality of its pulp, as can be tested by means of the faradic current (Ivy). In many cases regeneration of nerve

fibres occurs across the tissue that come to fill up the bony opening, or the tooth may gain a fresh source of supply from the plexus of nerves in the surrounding alveolar bone. In any case recovery of sensation and vitality ultimately occur in many cases, and even if it should not, the pulp of the tooth is not dead as its vascular supply had not been affected.

In this series of 70 cases varying degrees of numbness had followed after operation in 24 cases, but in most it disappeared in three to 6 months, persisting at the time of re-examination in only 2 cases (2.9%). In one of these there was loss of sensation of the first pre-molar and in the other of the canine tooth. In nine cases there was some numbness of the mucosa above the gum proper and more over the canine fossa area. In all of these, except two, there was no associated numbness of the teeth.

Post-operative Swelling of the Cheek and
Neuralgia of the Face.

The literature of the radical antrum operation shows that writers have made much of the occasional occurrence of these features in the post-operative history of the case, in decrying this method and contrasting it unfavourably, in this respect, with the intranasal antral operation. This is sometimes reflected in the attitude of patients who, having received unfavourable information from their friends or the family physician regarding these complications, are dubious about agreeing to the performance of the radical antrum operation and so might forego the benefit to their health which it offered. The physician should know that, whatever their incidence may have been in the past, these complications do not occur to the extent that they should carry any weight when deciding as to the type of antral operation to be performed. In this series of 70 cases swelling and tenderness of the cheek occurred in 4 cases only, (5.7%), lasting for an average of 4 days. One case was associated with a rise in temperature for which sulphapyridine tablets were administered.

The method of exposing the canine fossa is calculated to reduce the incidence of both the swelling of the cheek and the neuralgia of the face to a minimum. As has been pointed out the incision is made high in the gingivo-labial fold - directly over the canine fossa, and it is also given a curve downwards

so that a good exposure of the fossa can be obtained by stretching it, the stretching force being expended in straightening it and is not communicated to the soft tissue of the cheek. The curve allows the formation of what is really a small upper flap of muco-periosteum which is freed and which 'takes' most of the force expended in exposing the canine fossa. It acts the same way as the more definite flap formed by the right-angle incision introduced by ¹⁹Monson (1935) in an attempt to overcome many of the disadvantages associated with the lower situated transverse incision. A shorter incision is also adequate and so less damage is done to branches of the infra-orbital nerve.

The ease of exposure of the fossa or the ant. wall above it does away with the necessity of excessive reflection of the soft tissues in an upward direction towards the infra-orbital foramen, or of traction in this direction, which would cause contusion or stretching of the infra-orbital nerve. If this should happen troublesome neuralgia of the face and side of nose or other disturbances in sensation might follow in the areas supplied by this nerve. In this series of cases there was no instance of neuralgia, but one of paraesthesia of the cheek. A more common but much less disturbing feature was the presence in 30 cases of a varying degree of 'ache' in the cheek when the patient has a cold or is out in a cold wind.

This is often more definitely localised over the canine fossa. This is clearly not a true neuralgia but probably a 'neuritis' of damaged nerve-endings in the sites of the old incision or bony wound, or a 'rheumatic' type of fibrositis in the new fibrous tissue formed in these areas.

The Effect on the Eustachian Tubes and the Tonsils.

These are more intimately related with the sinuses in the living subject than even their anatomical relationship would suggest. The streams of secretion created by the ciliary activity of the nasal and sinus mucosa and directed backwards into the nasopharynx pass down into the pharynx in close relationship to these structures. The experiments of ²⁰Lowndes Yates have shown how the principal stream coming from the antral ostium passes along the upper part of the middle meatus, turns outwards and downwards and forms a track in front of the orifice of the eustachian tube. From this point it passes down the lateral wall of the pharynx, between the attachment of the soft palate and post. wall, and extends as a definite stream just behind the post. pillar of the fauces. From this part some of the fluid is in all cases directed anterior to the post. pillar to find its way into the recess between the tonsil and the post. pillar. When definite sinusitis is present the stream becomes more sluggish and stagnation and overflow occur at points where it changes direction or meets the lesser

streams from the ethmoidal sinuses. Such a point is in front of the eustachian orifice where overflow would occur over the edges of the eustachian cushion and provide a ready source of infection of the tube and middle ear.

The Eustachian Tube and Middle Ear.

In 32 cases there was some abnormality of one or both drums, viz.:-

Retracted	- - - - -	19
Retracted and scarred	- - - - -	11
C.O.M.S. with purulent discharge		2

Whilst these changes might or might not have been due to the sinusitis there are cases where the onset of the ear complaint followed shortly after the onset of the antral disease and was in most instances cured by its removal:

1 case of C.O.M.S. became dry and healed.

3 cases complaining of Tinnitus - 2 Cured
1 unrelieved.

5 complaining of deafness - * all cured.

The Tonsils:

The close association of the descending track of the secretions with the tonsils would lead one to expect a high incidence of tonsillar infection in these cases. If previously healthy the tonsils, infected after the onset of the sinusitis, become large and red. If the course of the sinusitis is not

protracted there is a chance that the tonsillar infection might be thrown off and the tonsil return to normal. In 2 cases the previous notes had recorded the presence of such tonsils in fairly recent cases and when re-examined they appeared small and not obviously septic. In the greater majority of cases, however, the tonsil never recovers completely and it is difficult to say afterwards whether the removal of the antral infection had produced any marked improvement. Although tonsillar sepsis might have been present from other causes before the onset of antral infection it might be recorded that when re-examined again, 44 cases (62.9%) showed the presence of definite tonsillar sepsis, and in many cases pus could be expressed from them from situations other than the superior tonsillar fossa.

The Effect on Headache.

Headache is a very prominent symptom in nasal sinus disease. It is often the only symptom for which the patient seeks relief. Its relationship to sinus disease is often not immediately apparent and many patients had first been attended by the physician, who having excluded such systemic sources as disorders of the blood, raised or lowered blood-pressure, hepatic and renal toxæmias, referred them for examination of the nose and throat. In many such cases the headache overshadows other symptoms of nasal disease so that these are often not recognised or - denied by the patient.

Headache was a prominent symptom in 42 cases (60%). Following operation complete relief occurred in 21 cases (50%), great relief in 10 cases and little or no relief in 11 cases. The types of headaches were as follows:-

Generalised	Frontal	Frontal + vertex or occipital or mastoid.
-------------	---------	---

16

17

6

Occipital	Pain behind eyes.
-----------	-------------------

2

1

In 5 cases giddiness accompanied the headache which was frontal in type in 3 instances,, and occipital in 1, and generalised in 1. With the frontal type of headache the giddiness was most marked when blowing the nose, but no association could be found to explain the other two cases with dizziness. ²¹Sluder makes mention of such instances of giddiness occurring in disturbances of the nose, but offers no explanation for their occurrence. A few might partly be explained by the presence of unilateral eustachian catarrh and obstruction.

Many of the generalised type of headache were probably due to a systemic intoxication from the infection in the antrum. These were all relieved after operation. Where a pansinusitis was present the headache tended to be referred not only to the frontal region but also to the vertex, occiput and mastoid regions.

11 cases were unrelieved. One of these was due to an occipital fibrositis. The remaining 10 were all of the frontal type and when an explanation was sought for their persistence the following information was gained :-

	I.	II.	III.	IV.
	Cured	Much Improved	Somewhat Improved	Not Improved
Percentage showing unrelieved headache.	-	20%	30%	50%
Adverse factors present:-				
Deviated septum & hypertrophies	-	50%	33.5%	20%
Deviated septum & polypi recurrence	-	-	33.3%	40%
Ethmoiditis	-	-	33.3%	20%
Inadequate antral Operation	-	-	-	20%
Poor general health or bad surroundings at work		50%		

The better the total end-result the less the proportion of unrelieved headaches. The table also suggests that the correction of deviated septum and hypertrophies would, especially in the case with the better nasal result, have removed an important factor preventing permanent relief of the headache.

General Improvement following Antral Treatment.

Practically all the patients seen, irrespective of the ultimate nasal result obtained, experienced definite general improvement 3 to 5 months after operation. Free drainage of an important focus of infection must, even if it is not completely eradicated, stop toxic absorption into the blood. If in addition such symptoms as headache or 'dulness' in the head are relieved, the effect on the general health is all the more enhanced. Patients will state that they feel stronger, have more energy and general 'stamina', tire less easily than formerly and feel more alert and have a greater zest for life. Only 2 cases failed to experience any general improvement; one suffered from asthma and repeated colds, and the other belonged to the group IV. category and had recurrence of polypi.

The interval after operation before general improvement is felt is fairly constant and corresponds closely with the time necessary for regeneration of the antral mucosa to take place. During this interval the patient experiences very little real difference in his general health and has had the strain of an operation in addition. The patient should know about this interval before real improvement sets in lest he become discouraged, and the physician should know so that adequate convalescence can be arranged. Furthermore no further operative procedure should be undertaken during this interval while the patient is in a "refractory phase".

The Effect of Antral Drainage on Diseases of the Lower Respiratory Tract.

Chronic sinusitis not only reduces the defensive mechanism of the nose and so lays the lower respiratory tract open to the attack of irritants and bacteria in the inspired air, but by its production of discharges gives a ready-to-hand local supply of organisms for attack on the larynx, trachea, bronchi and bronchioles. The lymphoid tissue of the faucial tonsils and the lymphoid aggregations of the Post. pharyngeal wall are the first to be infected by the descending stream of secretions from the naso-pharynx.

²⁰Lowndes Yates has shown how the preater portion of this stream descends along the post. margin of the post. pillar and reaching the sinus pyriformis it flows on to the post. aspect of the arytenoids, finding its way into the interarytenoid space and sometimes into the trachea itself. The resistance need only be lowered by intercurrent colds etc., for a generalised mucosal inflammation of the lower pharynx and upper aperture of the larynx to take place, which by surface extension would give rise to a laryngitis, tracheitis or bronchitis. For a long time the ciliary activity of the tracheal and bronchial mucosa, working in an upward direction, may repel excessive invasion of bacteria but it will be crippled by repeated attacks. Furthermore with large amounts of secretion present close to the interarytenoid space, secretion might be inhaled in large amount especially during sleep when

it is not removed by swallowing to the same extent as during the waking hours.

²²Myer and Quinn have shown how the presence of iodized oil introduced into the nose during sleep is subsequently revealed in the lungs by X-ray in 5 out of 11 persons.

The most convincing evidence of the relation between sinus disease and infection of the lower respiratory tract was obtained by Wasson and Waltz, quoted by ²³Salinger, in their study of 100 children at three monthly intervals from birth to the age of 10. The onset, severity and improvement of sinus infection were paralleled by disease of the bronchi. So close was the relationship that they suggested the term "broncho-sinusitis" for such a combination of conditions. Kerley and Lorenze (quoted by Salinger) showed, as has already been pointed out earlier on, that antral infection is the usual type of sinus infection in children.

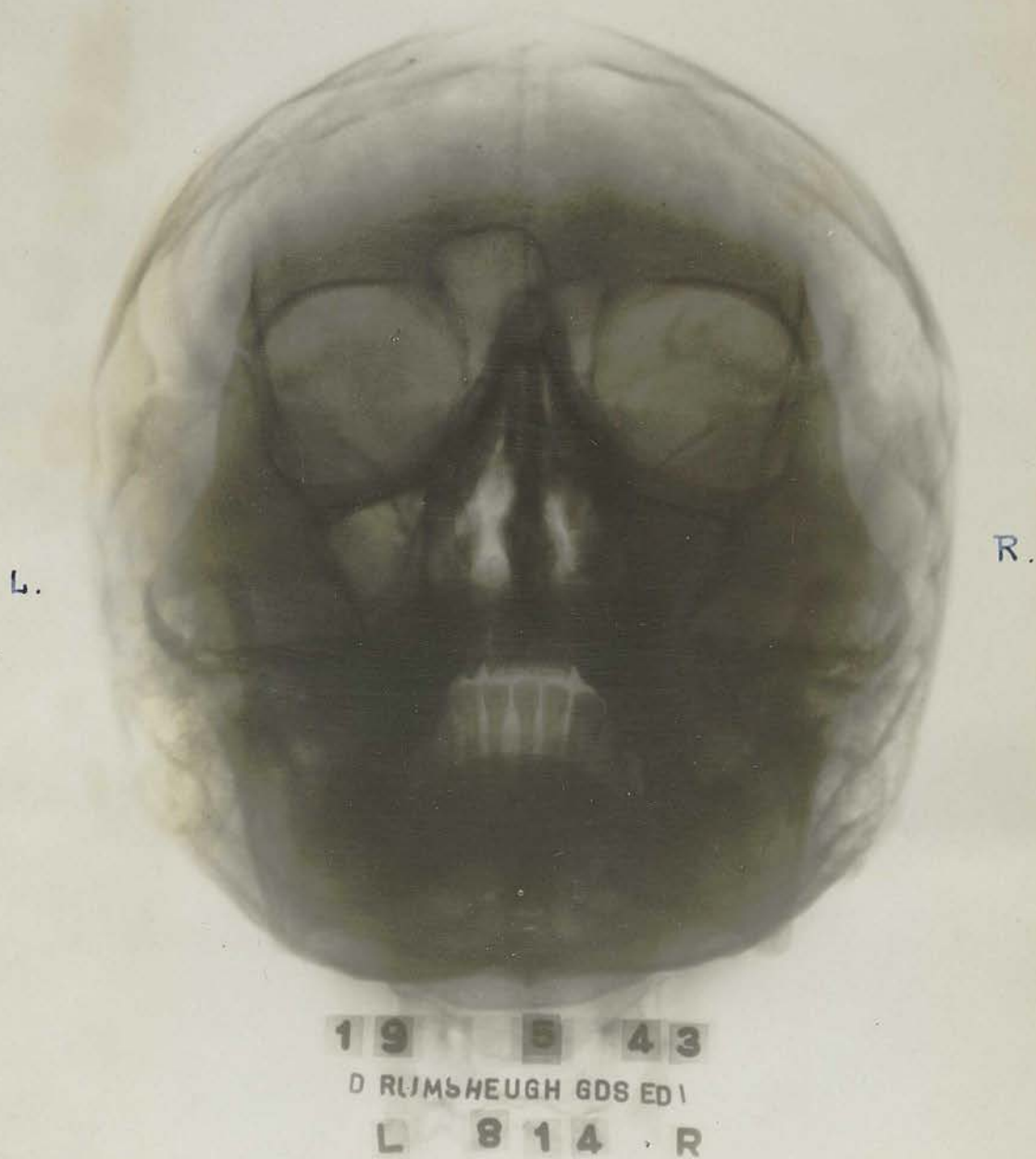
If the sinus infection is eradicated the lower respiratory tract may recover completely or it may be left susceptible to re-infection by damage of its ciliated epithelium protective mechanism, or it may remain in a state of chronic infection by infiltration of organisms into its subepithelial tissue. It may also have become "sensitised" by bacterial toxins and liable to re-infection or the development of asthmatic attacks.

In this series of cases there were 11 cases (15.7% where the antral infection was associated with affections of the lower respiratory tract:-

Laryngitis and bronchitis	-	5
Bronchiectasis	-	3
Asthma	-	3

In all the cases with laryngitis and bronchitis, the antrum contained pus at operation. In 4 the nasal condition was either cured or much improved and in these complete relief of the chest condition followed. In the fifth case the nasal condition was not improved nor did the bronchitis show any improvement.

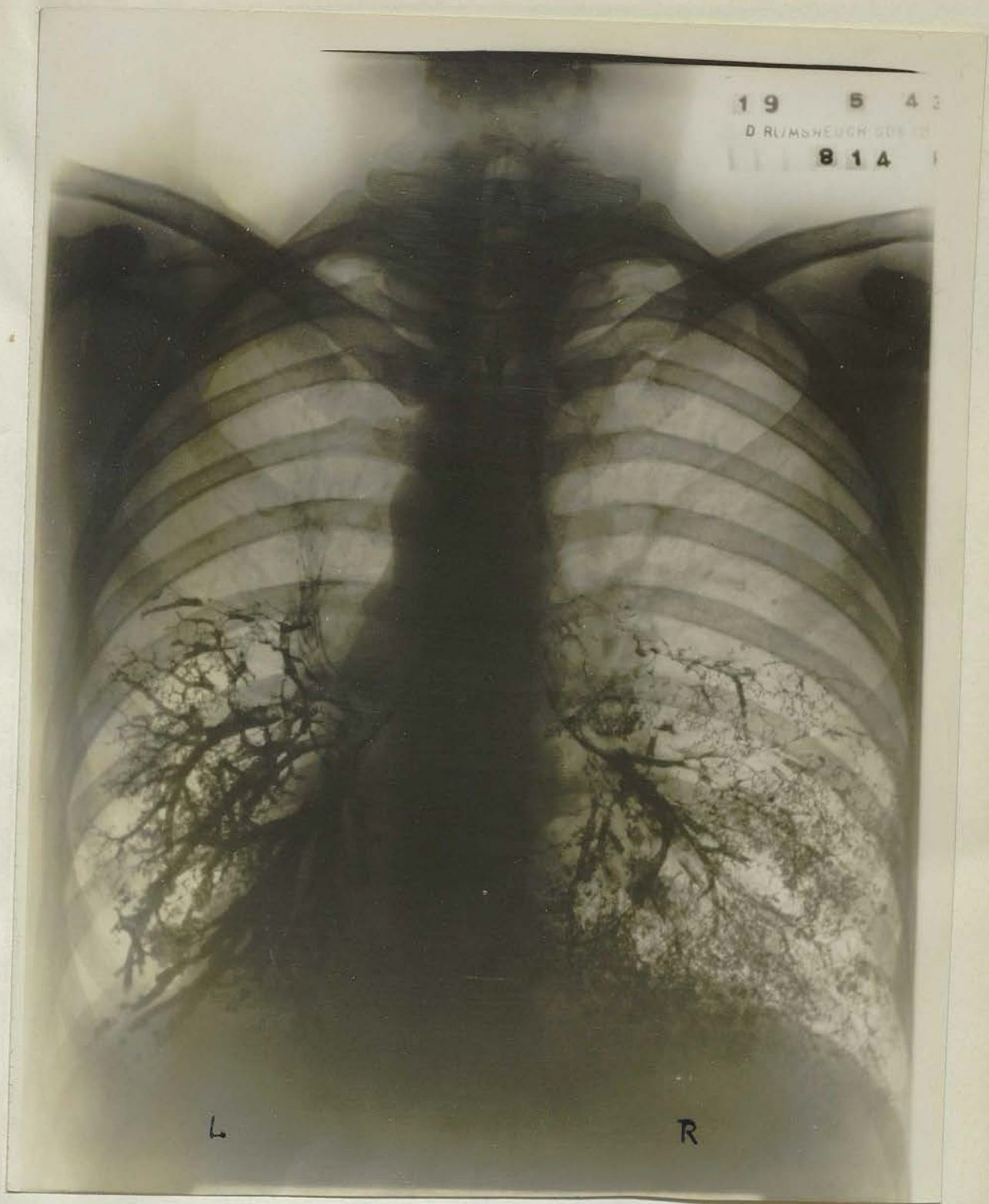
In the case of bronchiectasis ²³Salinger quotes Clerf, who observed 200 cases of bronchiectasis and found concurrent infection of the sinuses in 82.4%. ²⁴Robertson in 86 cases of bronchiectasis found it present in 45.3% of cases. These observers only included cases where the sinus disease was primary and causal. Rare cases are met with where the reverse is true. They do not state which sinus was predominantly infected but in the 3 cases occurring in this series the antrum alone was responsible in every case. In each case there had been a suppurative sinusitis - bilateral in one and unilateral in the other two - with much thick pus in the antrum. When there is so much pus present direct inhalation of pus probably carries infection direct to the terminal bronchioles, although it is believed that infection is also carried from higher up the tract by the peri-bronchial lymphatics



Case 69. X-ray of Sinuses. — Showing marked opacity of the Right Antrum.

The abnormal roominess of the Nasal Fossae is also evident — due to atrophy of nasal mucosa and Turbinates.





Case 69. X-ray of Chest following Lipiodol
Injection of Bronchi. Tubular Bronchiectasis of Left Lower Lobe.





Case 69. X-ray of Chest. - Lateral View. -
after Lipiodol Injection of Bronchi.

The uniform tubular dilatation of the
branches of the Bronchial Tree of the Left Lower Lobe
is well shown.



so that the bronchiolar walls may also be attacked from without.

Case 69 - illustrates the remarkable improvement that can follow antral drainage even in an established case of bronchiectasis if the constant supply of pus from the nose is stopped. This patient, a man, aet. 32 - had had a long history of nasal trouble, which gradually became worse, with much crusting in the nose, until the expectoration of bad-smelling sputum started. He was then tiring easily, but there was no sweating; the appetite was poor. There was an atrophic rhinitis of the nose with much crusting in the naso-pharynx.

X-ray examination of the sinuses revealed an opaque right antrum (See photographs of X-ray plate). The abnormal roominess of the nasal fossae is also apparent.

X-ray examination of the chest showed that there was marked fibrosis of the left lung, and another X-ray after lipiodol injection of the bronchi showed a definite tubular bronchiectasis confined to the ^{left} lower lobe. (see photographs). This is also strikingly shown by the lateral view.

This was so marked and unilateral in distribution that a lobectomy of the lower lobe was contemplated. It was decided to drain the antrum first. This was done and the patient returned home for convalescence. On being examined again 1 month later



Case 69. 1 month after Antral Operation.
X-ray of Chest following Lipiodol injection of Bronchi :
Showing marked improvement in the Condition
of the Terminal Bronchial Tree of Left Lower Lobe

further lipiodol studies of the lung showed that the previous condition had improved so much that lobectomy would not now be required. In addition all his symptoms including cough with purulent expectoration had disappeared. The nose still showed mucosal atrophy but was clear.

The second case (case 67) of bronchiectasis had had a long history of bronchitis and asthma but the added presence of bronchiectasis was shown on routine examination. Following drainage of both antra and removal of diseased antral mucosa the patient experienced immediate benefit.

In the third case there was before operation an X-ray picture of a 'bilateral basal bronchiectasis with partial collapse of both lower lobes'. After operation on both antra, immediate improvement followed and was maintained for several months until, on getting a series of colds, cough started again. Even so the X-ray picture a year later showed evidence of chronic bronchitis only.

All these cases showed mucosal atrophy of the nose, but the presence of much pus in the nose at the time of examination was not a marked feature. All, however, had much thick pus in the antrum. The thick pus, escaping into the nose in small amounts, is dried in the roomy nose into crusts which are the more easily inhaled and which are of high infectivity.

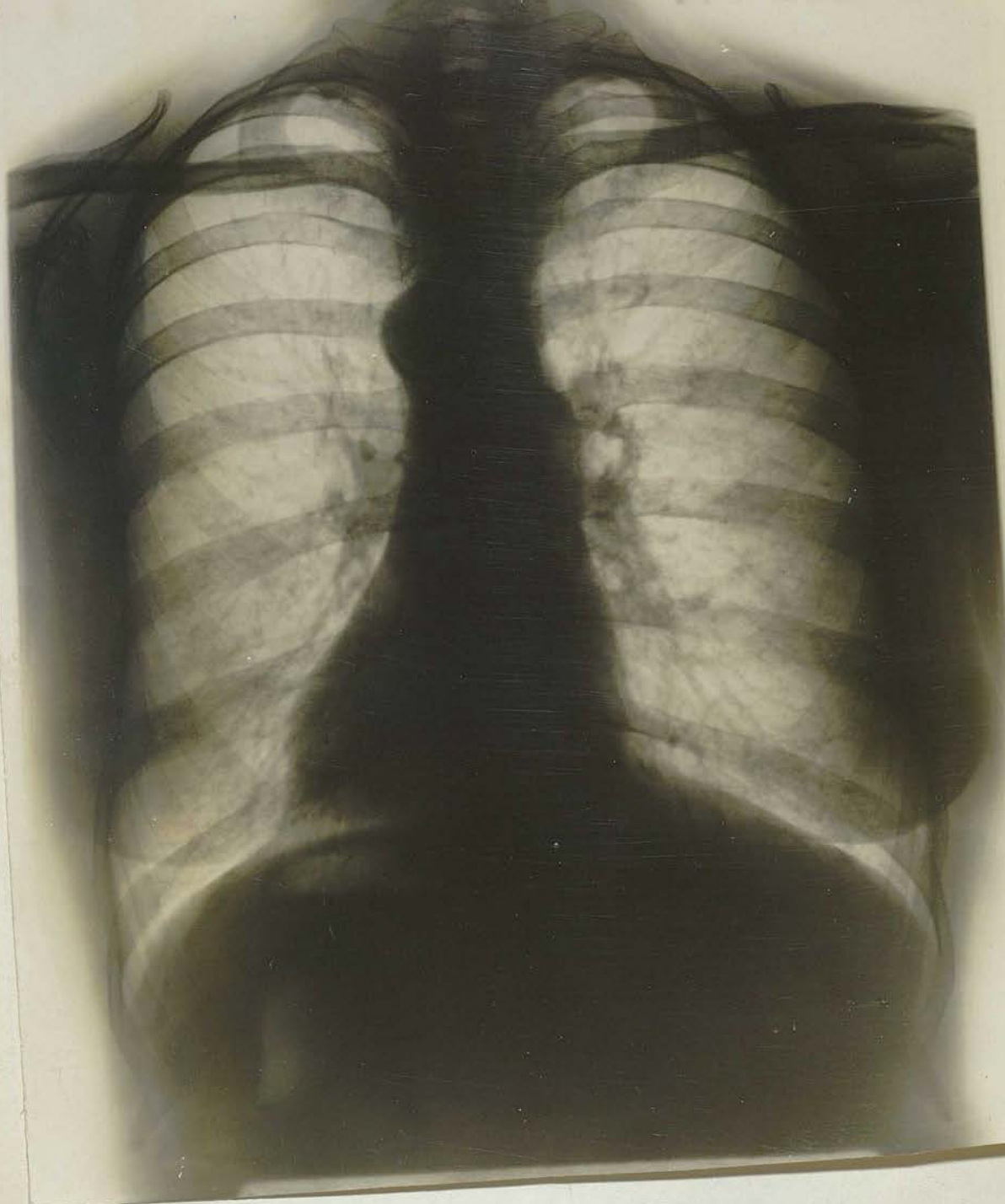
25 Goodale reviewing 25 cases of bronchiectasis



Case 67. X-ray of Sinuses : Showing dulness
of both antra and a fluid level in the Right antrum.



14 6 3
D RUMSHEUGH GDS ED1
168 R



Case 67. X-ray of Chest : Showing marked
Bilateral peri-bronchial thickening and dilatation.



associated with sinus disease, points out that although dramatic improvement often occurs within the first few weeks after operation on the sinus, this is not always maintained at the same high level. Nevertheless the patient's general condition is so much improved that lobectomy could be undertaken with greater safety and so complete the cure. The nasal condition is sufficient to augment and protract the chest conditions. This applies not only to bronchiectasis but also to asthma, cases of suspected or diagnosed pulmonary tuberculosis etc.

Asthma and Antral drainage.

The literature abounds with conflicting reports as to the results obtained in asthma from sinus surgery. The most optimistic reports appear and also the very opposite. These are of great interest to the physician who is in prolonged attendance on cases of this distressing complaint. Interest has centred on the relationship between the nose and the bronchi ever since the recognition of a naso-pulmonary reflex, and it was hoped that removal of a nasal abnormality might cure the asthma. What are the results where the associated nasal abnormality is antral infection?

When studied in relation to nasal infection two types of associated disease are found:-

(a) Sinus infection but no other abnormal process present in the nose. The associated asthma follows a long history of chronic bronchitis. Here the bronchi

have become sensitised to bacterial products or have themselves become chronically infected so that complete freedom from asthma after sinus surgery cannot be expected.

(b) In allergic cases - where both the sinus infection and the bronchial spasms are the result of the same underlying allergic principle. Here the sinus suppuration should be cleared up to improve the patients' resistance but complete cure of asthma cannot be promised.

The antrum was the only sinus involved in the 3 cases of asthma in this series. In one case the sinusitis was of the hyperplastic-allergic type and in the other two of the chronic suppurative type. One experienced relief immediately after operation especially as regards the shortness of breath complained of, and the improvement was still being maintained 1 month after operation. In another the attacks became more frequent after operation and then became less frequent and less severe. In the third there was no improvement. The latter two cases seen again five and two years after operation still suffered from asthma, but they were better in general health and were definite that they benefited from the operation.

¹⁵Warner and McGregor reporting on 31 cases of the first or 'bronchitic' type of asthma associated with varying degrees of antral disease found that

when observed from 6 months to $2\frac{1}{2}$ years after operation only 2 showed favourable and permanent results. All cases had an average period of 4 months of freedom from attacks but relapsed later. The shortest was 2 weeks and this minimum was so constant that in one case it was used as a life-saving emergency measure to stop what seemed a fatal termination. Cases most benefited had asthma for a relatively short time and presented markedly thickened antral mucoperiosteum. Otherwise there were no indications which would help one to decide in the selection of cases.

It could be concluded from one's own and reported findings that wherever present in a case of asthma, antral infection should be treated and eradicated by the radical operation. The majority of patients experience immediate improvement, and even if this is not maintained indefinitely, the attacks often become less severe and less frequent and, what is more, that the patient's general condition is so much improved that he can stand up to them better.

The Effect of Antral Drainage on Remote Complications.

In the case of the lower respiratory tract antral infection acted as a source of supply of infective material descending into it. In many instances other structures of the body remote from the respiratory tract suffer as the result of focal infection in a sinus. Toxic bacterial products manufactured in the sinus are absorbed either directly into the blood stream via lymph-vascular channels from the sinus or are absorbed from the gastro-intestinal tract from discharges that had been swallowed. In cases of longstanding infection the organisms themselves, having penetrated deeply into the mucosa, invade the periosteum and bone and come in contact with the venules in the Haversian system. They may now cause a septic thrombosis of these venules (Logan Turner and Reynolds) and be distributed in septic emboli, or they may pass directly into the venous bloodstream and produce a bacteriaemia. Neighbouring structures, such as that of the orbit and the meninges, being in the path of venous drainage, may be expected to suffer many complications. Carried in the peripheral circulation the organisms are apt to attack connective-tissue in muscles and fasciae, joints, peripheral nerves, endocardium and the endothelium of peripheral arteries such as those of the myocardium. The selection of the particular tissue is to a certain extent determined by its selective affinity for the particular organism.

(Rosenow and Besredka). If no reinforcement occurs from the sinus infection the organisms may either be overcome by the local tissue defence or if too well established they may continue in existence as secondary subacute focal points of reaction.

It has already been shown that toxæmic absorption from antral infection played a part in producing a type of headache. The functions of the brain may also be affected with the result that mental dulness and apathy or severer changes in the mental state and even insanity may follow in certain individuals. ²⁶Watson-Williams, has collected a large number of cases illustrative of this. Three cases were met with in this series where mental dulness and apathy was a notable feature in their history. In one case it bordered on acute melancholia. This patient, Mrs A.P. Aet. 49, also suffered from associated headache, general malaise and joint-pains. Her condition was the cause of considerable alarm to the family physician. Complete relief followed 3 months after removal of bilateral antral infection and when seen again $4\frac{1}{2}$ years later she was free of all former symptoms and her mental outlook was normal. The other two cases experienced similar improvement.

The effect of toxæmia on the gastro-intestinal system was shown in the case of Miss F.G. (Case 66) Aet. 21 who used to suffer from attacks of acidity, nausea and vomiting. This was much improved when seen again 5 months after operation. This is in accordance

with the findings of Karpowa (quoted by Salinger²⁷) that a definite connection exists between infections of the antrum and gastric acidity.

When cases were considered where certain distant structures are singled out for attack by organisms in the peripheral blood-stream the following were met with:

Three cases of peripheral neuritis.

The antrum is certainly not quite such an important focus as the tonsils in this respect, or its recognition as such is not so old or wide-spread, so the following case is very illustrative of what an important part it may have: Case 68 - Mr G.G. Aet. 43. - had had a long history of nasal discharge and frequent colds which were worse at some times and accompanied by deterioration of memory. He had also suffered from duodenal ulcer which was successfully treated by medical means. Six years before his operation X-ray examination of the sinuses proved negative. Yet he continued to have discharge and conservative nasal treatment had little effect. Four months before operation an acute sinusitis of the left antrum developed. The antrum was washed out but nevertheless, and in spite of free drainage of discharges, tachycardia and peripheral neuritis of the legs appeared, and there was also weakness of pupillary accommodation. The peripheral neuritis became steadily worse and the knee-jerks became absent. Operation was decided upon. The left antrum was opened and its lining was found to be fibrosed and densely adherent to the antral wall. It

was stripped off with difficulty and removed and the usual counter-drainage opening made into the nose.

Considerable improvement followed and 6 months later the neuritis had recovered and the toxic symptoms were disappearing. Following a cold there was a slight return of the neuritic symptoms and further investigation showed a residual infection of the left ethmoid and the right antrum. These were treated and his progress continued uninterruptedly.

The connection in this case between the antral infection and the peripheral neuritis and tachycardia (which was very likely due to a similar condition of the cardiac nerves, bundles or nodes) was unmistakable. It was proved by their appearance at the time of the acute exacerbation and by their immediate improvement following antral drainage, although some residual infection needed clearing up to complete the cure. The fibrosed adherent lining membrane of the antrum denotes a very chronic infective process that had penetrated to the periosteum and bone. In such a case ordinary radiological examination of the antrum might not suggest much disease, and as Watson-Williams points out, rhinoscopic and even proof puncture and lavage examination of the antrum might also furnish very little evidence of such a deep-seated infection which had completely disorganized the mucosa and become shut off by fibrosis from the antral cavity. Yet toxic and bacterial absorption occurred all the time by lymph-vascular channels in the

walls of the sinus. As a focus of infection such cases are often truly "cryptogenic".

One case presenting occipital fibrositis and another sciatica were unrelieved after operation. In the latter the condition had been present for 8 years prior to treatment, and in neither were there any incidents in their history and the history of the sinusitis to suggest a relationship.

Neuralgia of the 5th Nerve.

Watson-Williams recognizes that neuralgia of this nerve may be due to a neuritis from paranasal sepsis. In one case of this series it was present as a neuralgia of the maxillary and mandibular divisions of the 5th nerve on the same side as an infected antrum. Drainage of this produced no marked improvement.

Arthritis.

Case (44) Mrs M.B. aet. 48. had had painful swelling of the ankles and wrists of the "rheumatoid" type for several years. Definite improvement followed 2 months after operation and was maintained when seen 2 years later.

Another case of more vaguely definite joint-pains got complete and permanent relief after operation.

Orbito-ocular Affections.

Watson-Williams quoting from his own experience and that of others, have shown the multitude of

eye conditions that might be due to sinus infection. These range from blepharitis to lenticular opacity, iritis, choroiditis and optic atrophy. In this series there was one case, (Case 5) of iridocyclitis on the same side as an ethmoidal and antral infection. Antral drainage alone, did not produce any benefit, but as the antral infection was probably the primary infection, its earlier treatment would have prevented the development of the ethmoiditis which was the cause of persistence of the eye condition.

S U M M A R Y.

An introductory study is made of the physiological function of the nose as the first line of defence of the air passages. These consist essentially of an upper part formed by the nose and naso-pharynx, and a lower part comprising the larynx, trachea, bronchi and bronchioles. Interference with the proper functioning of the nose may have injurious results in the lower respiratory tract and therefore the interests of the physician and the rhinologist meet on common ground.

The ciliary-mucus defence mechanism of the nose is outlined in the case of infective organisms invading the nose and its accessory sinuses. If the defence is overcome the progress of an acute sinusitis is followed and it is shown how in a rigid-walled space such as the antrum, Nature's method of overcoming the infection is by means of re-establishing its drainage and aeration through its natural ostium, and by the attempt at replacement of damaged lining membrane by one having normal ciliated epithelium. It is then shown that in the presence of certain adverse factors in the nose, such as deviated septum, the complete opening of the ostium is interfered with and the infection in the sinus becomes chronic. The sinus now becomes a suppurative focus, giving rise to toxic discharges which pass into the nose and throat, and from which toxic products and bacteria may pass directly into the blood-stream.

The maxillary antrum lends itself to study since it is the sinus most often infected and which for a long time may remain the only sinus infected. In addition, its infection often dates from childhood.

The rhinologist follows the principle of drainage and aeration whatever his treatment of the sinusitis may be, but in chronic infection he aids the reparative process of nature by removing the diseased, and often disorganised lining membrane, and by making an artificial drainage opening into the nose. This opening is situated nearer the floor of the antrum and is of more favourable size than the natural ostium.

Following a short historical review tracing the evolution of the method used, a description of the method of access and drainage is given as embodied in the classical Caldwell-Luc operation with certain modifications, such as the high gingivo-labial incision, and the formation of a mucosal flap which is laid into the antrum. The method of anaesthesia, and the precautions taken to safeguard the lower respiratory tract against blood or secretions flowing down into ^{it} are outlined.

A clinical study then follows of 70 cases of chronic maxillary sinusitis. The local effects are traced to see in how far the procedure succeeded, not only in removing the disease and promoting drainage and aeration of the antrum, but also how this was accomplished along the lines of the physiological principles of the nose, so that a healthy nose and antrum may remain.

The studies first of all showed that the antrum does not become obliterated after removal of its lining membrane, but retains its form and shape and becomes, in fact, lined with a newly-formed membrane. Support of this finding and reports of the histological examination of this membrane are given from the literature to show that the desired ciliated epithelium is regenerated in 3 to 5 months. When this has occurred the antral cavity can again assist at its own drainage.

The functions of the artificial antro-nasal opening are outlined by a study of cases where it had closed, and it was concluded that it has a primary

function of drainage and aeration of the antrum in the first 3 to 5 months, before the regeneration of its epithelium, after which no ill effects would follow its closure, provided no adverse factors are present in the nose that favour re-infection of the antrum in which case its continued use would be highly desirable. It is also shown from cases that where certain adverse factors are present in the nose or recur, the presence of an opening tends to reduce their ill effects on the patient. With reference to cases the optimum size of the opening is discussed in the light of the desired functional results. It is shown that nothing is gained by making the opening too wide, as much of the suction-drainage effect on the antrum would be lost.

The role of the mucosal flap is shown to be that of providing a convenient nidus for the outgrowth of new ciliated epithelium into the antrum, and secondly of helping to maintain the patency of the antro-nasal opening especially at its important rounded ant.-inferior angle.

The effect on the inf. turbinate is studied in the light of its important function of shaping the inspired air-stream in its arched course in the nose and thereby being an integral part in the method of suction-drainage of the accessory sinuses. Interference with this structure at operation should be minimal and even if somewhat enlarged, there is a tendency for it to shrink afterwards. In addition, atrophy of the nasal

mucosa produced by the old disease often persists giving a roomy nasal chamber where the presence of a reduced inf. turbinate would the more disturb the direction and force of the inspiratory air-current.

A clinical estimation then follows of the results of this method of drainage on the antral infection and the associated changes it had produced in the nose. The aim of this method and the principles it embodied was to render the patient free of symptoms and gain a normal antrum and nasal cavity free of abnormal secretions. Using this desired result as standard 45.7% of cases were "cured", 21.4% were "much improved", 14.3% were "somewhat improved" and 18.6% derived no local benefit. The causes for the less favourable results were studied in detail and were shown to be due to certain adverse factors present chief of which were, first and foremost, residual ethmoidal (and sphenoidal) infection, and secondly the persistence of the allergic diathesis with recurrence of polypi. The persistence of the latter caused less favourable results in 14.3% of all the cases (or 26.3% of the "uncured"). Where septal deformity was present polypi tended to recur and a poorer result followed. Apart from the further treatment of septal deformities and hypertrophies the patient should receive general medical treatment directed against the allergic diathesis failing which, the effect of radium application might be tried.

Residual ethmoiditis (and sphenoiditis) was the

adverse factor present in 20% of all cases (or in 30.7% of the "uncured"). The potential danger of its persistence in causing severe complications after operation is stressed. In the "not improved" group it was the factor responsible in 70% of them and its persistence was associated with the persistence of severe types of headache, nasal-discharge and re-infection of antrum and remote symptoms of toxic origin. Methods were discussed to minimise the difficulties attendant on adequately dealing with ethmoidal infection at the time of the antral operation, and amongst others, the transantral method of approach to the ethmoid was discussed, whereby using the usual method of ether anaesthesia both the antrum and the ethmoid could be dealt with through the one approach.

The effect of the operation in producing possible damage to the nerve-supply of the teeth and gums and of producing severe swelling or infection of the cheek, or after - neuralgia of the cheek, is studied in this series of cases. It was found to be minimal and not sufficient to detract from its superior advantage as a physiological procedure.

The effect of the antral treatment on the Eustachian tube was shown to result in the cure of an appreciable proportion of cases of tinnitus and deafness. In the case of the tonsils only two cases were found where a healthier-looking tonsil resulted afterwards. Tonsil sepsis was still present in 62.8% of all the

cases and even if originally caused by antral suppuration sepsis would most likely persist unchanged.

The important symptom of headache was present in 60% of cases before treatment and was completely relieved afterwards in half of these and greatly relieved in another quarter.

Headache that persisted unchanged was entirely of the frontal type and was largely associated with the presence of septal deformity and ethmoiditis.

It was shown that all but 2 cases experienced definite improvement in their general health after operation which pleased them very much even where the local result was not entirely favourable. This occurred after an average interval of 3 months during which the patient's general condition and resistance must be considered, as regards the imposition of further stresses, to be in a "refractory phase".

Diseases of the lower respiratory tract were present in 15.7% of these cases. The modes by which antral infection produces these diseases were outlined and the results obtained are given when the causal condition is removed. Four out of five cases of chronic bronchitis cleared up completely with the cure of the antral disease. Three cases of bronchiectasis were met with. One showed dramatic improvement, clinically and radiologically, after antral drainage and the other two were much improved, especially as regards their general condition. In this connection it is pointed

out that all chest cases including those of pulmonary tuberculosis, would benefit by the removal of co-existent, if not causal, sinus infection. Cases of asthma were less promising since sensitivity existed, both as the result of the bronchial infection and as the result of underlying allergy. In the first type the sensitivity may persist even after antral infection is removed. Yet based on the results, seen in the 3 cases studied, and from the reported literature, one might help the physician in advising treatment by stating that the majority of asthmatic patients obtain improvement. Whilst a few are cured, in many the attacks become less severe and their general condition is so much improved, that they can the better carry the burden of the disease.

The pathology of antral infection in causing remote complications is outlined. Cases are quoted from this series of affections of the gastro-intestinal tract, brain function, peripheral nerves, joints and the eye. It was shown that following removal of the antral infection most of these, if in relationship to the infection, may be expected to clear up completely or, if ^{of} too long standing, at least become improved. This relationship was especially studied in one case of peripheral neuritis and tachycardia, and using it as an object lesson it was shown that the antrum, as the possible focus of infection, might easily be overlooked when examined by the usual radiological and clinical methods because of the type and latency of the pathological pro-

process present. Chronic antral infection should be more widely recognized as a point of focal infection, when its significance may be revealed, as being not much less than that of tonsillar sepsis.

References.

1. St. Clair Thomson "The defences of the air passages",
Jour, of Laryng. and Otology, Jan., 1936.
2. McArthur - Med. Jour. of Australia.
Sept. 18, 1937 2 : 470.
3. Tilley, H. Jour. of Larngy. and Otol. 1932: 47.
4. Skillern. "Accessory Sinuses of the Nose" 1916.
5. Glatt, M.A. Archiv. of Otol. 1938 Vol.xxvii: 323.
6. Knowlton, C. Archiv. of Otol. Dec. 1928 8 : 647.
7. Gorham and Bacher. Archiv. of Otol. 1930 6: 763.
8. Glatt, M.A. Archiv. of Otol. 1938 3: 331.
9. Barwell, H. Jour of Laryng. and Otol. Oct., 1929 :
674.
10. Miller, A. British Med. Jour. July 1936.
11. Scheideler. J. "Die Luftströmungen in der Mensch-
lichen Nase bei der Atmung".
Zeitschrift für Hals-Nasen und Ohren
heilkunde. 1938 : 44.
12. Stahl et. al. The Laryngoscope - March 1943: 186.
13. Formby, M. Jour. of Laryng. and Otol. June 1943: 241.
14. Watson-Williams "Chronic nasal Sinusitis"
2nd Edition: 215.
15. Warner and McGregor. Jour. of Laryng. and Otol.
1933.
16. Horgan, J.B. Jour. of Laryng. and Otol. Aug. 1926.
17. Ivy, R. Annals of Otolaryng. Dec. 1923.
18. Myers. Jour. of Amer. Med. Assoc. 1921.
19. Monson, L.P. Archiv. of Otol. Feb. 1935: 206.
20. Lowndes Yates "Methods of estimating the activity
of the ciliary epithelium within the sinuses".
Jour. of Laryng. and Otol. 1924.
21. Sluder, G. "Headaches and Eye Disorders of Nasal
Origin". Page 27.
22. /

References (Continued).

22. Myer and Quinn. Archiv. of Otol. Aug. 1929.
23. Salinger, S. Archiv. of Otol. Aug. 1935.
24. Robertson, H.N. The Med. Press and Circular
Jan. 12, 1944.
25. Goodale, R. Archiv. of Otol. Aug. 1943.
26. Watson-Williams. "Chronic nasal Sinusitis". p. 61.
27. Salinger, S. Archiv. of Otol. Aug. 1935: 216.
28. Watson-Williams. "Chronic nasal Sinusitis" P. 117.

A P P E N D I X.

- Case Notes -

Case 5. Mrs R.K.

First seen 10/1/39. Aet. 37. Housewife.

History. of hazy vision of right eye for 9 months.

She was referred from Ward 43 for an opinion as to the possible presence of an N.T. focus of sepsis. She was receiving local treatment for an iridocyclitis.

Subject to colds.

Had some obstruction on right side of nose.

Polypi had been removed from this side a year previously.

No ear trouble.

Anterior Rhinoscopy:- Polypi and pus in right nostril.

No view of interior of nose. No polypi seen posteriorly but some pus in right choana.

X-Ray Sinuses. Opacity of right antrum and ethmoid.

28/4/39:- Rt. Radical Antrum Operation:-

Pus in antrum. Mucosa thickened. Nasal polypi removed and ethmoid opened. Counter opening made.

25/6/39. c/o Right-sided headaches.

A.R.:- Pus in right middle meatus. Some atrophy rt. side.

26/6/39. Nose clear. Still headaches.

3/8/39. No headaches. A.R. Very little discharge.

20/12/39. Complaining of headaches on top of head.

Sharp gripping pain coming on suddenly.

A.R.: Nose fairly clear. No pus seen.

17/2/41. c/o Headaches. Eye Dept. Report:- Cyclitis in rt. eye but inactive.

Case 5 (Continued)

A.R.: Pus and polypi in right middle meatus.
Opening into antrum closing.

X-Ray:- Opaque right antrum.

20/3/41. Rt. Radical Antrum:-

Polypus and pus inside nearly closed.

Antrostomy opening. Rest of antrum fairly clear.

2/4/41. Still some pus and headaches. Good opening.

To use glycothymoline douche.

Examined again:-

21/8/43. Headaches on vertex and across head occasionally now.

Worse just before and during menstrual periods.

Not as bad as before operation.

Slight nasal discharge as compared with formerly.

No post nasal discharge.

Gets colds far less often.

No pain over face whatever at no time.

Feeling better in all ways. Working hard.

Felt improvement only after a year after operation.

Rt. eye still misty.

Anterior Rhinoscopy:-

Large roomy atrophic right nasal fossa.

Fairly large and irregular polypoidal right middle turbinate covered with pus.

Pus from middle meatus.

Right Antrostomy opening widely patent.

Naso Pharynx:-

Pus in Rt. Choana and on Eustachian cushions.

Case 5(Continued)

Adenoid remnant as clefts and ridges.

Pus in Rt. Superior Meatus.

No enlargement of post. ends of turbinates.

Larynx:- Cords reddened, showing leashes of vessels.

Membrana tympan. - normal.

Antroscopy:- Mucosa of antrum smooth granular appearance. No abnormal secretion seen.

X-Ray Sinuses:- Including vertico-mental view.

Opacity of Rt. antrum and obscurity of all ethmoids and both sphenoids.

Ophthalmological Report:- Active irido-cyclitis of right eye with opacity of vitreous.

Does not think there is optic atrophy.

At - Subsequent operation on Rt. Ethmoid:-

Entire ethmoid was necrotic and contained thick pus.

Case 8. L.O.

First seen 9/II/37. Aet. 3I. Handyman.

History:- Complaining of bad smell in nose and bad taste in mouth for two - three months.

Nasal obstruction and discharge.

Frontal headaches.

Loss of sense of smell.

No throat or ear trouble.

Duration:- 2 - 3 months.

Anterior Rhinoscopy:- Polypi and pus left side.

No view of interior.

Posterior Rhinoscopy:-

Tonsils small.

No adenoids.

Pus in choanae.

Polypi can be seen posteriorly.

L. M. T. :- Very transparent. Otherwise normal.

R. M. T. :- Normal.

For removal of polypi.

3I/12/37. Nasal polypi removed.

Temperature and rash - removed to City Hospital as suspected case of Scarlet Fever.

10/7/40. Ant. Rhinoscopy:-

Fleshy polypus rt. side. Muco-pus.

Septum to left. Mucosa thick and red.

Post. Rhinoscopy:-

Small ragged inflamed tonsils.

Adenoid mass in naso-pharynx just above post. edge of septum.

Soft swelling 'cushion' on Rt. side of septum.

Case 8 (Continued)

Post end right middle turbinate rather swollen.

No pus.

X-Ray Sinuses:- For removal of nasal polypi.

30/7/40. Removal of Nasal polypi.

11/8/41. Ant. Rhinoscopy:- Small polyp from rt. middle meatus surrounded by pus.

Right Proof Puncture:- Large amount of foetid pus.

18/8/41. Rt. Proof Puncture :- Foetid pus +++

For radical antrum

2/11/41. Rt. Radical Antrum.

Foul smelling pus in antrum. Polypoidal mucosa.

Bone soft. Counter opening made.

No flap made.

Seen again 29/9/43.

Still some discharge. No post.nasal discharge.

Less colds now.

Headaches over right eye when in stuffy atmosphere - Relieved by ephedrine drops.

Tinnitus Right Ear:

Some improvement in general well-being after operation.

Pain over right molar region when having a cold.

No numbness of gums.

Anterior Rhinoscopy:- Septum badly to right hiding rt. middle turbinate with spur low down.

Adhesion between spur and anterior end/^{of} inferior turbinate.

Pus from region of right middle meatus.

Large lowhanging left middle turbinate.

Case 8 (continued)

Post Rhinoscopy:- Lower remaining incisors ^{are} /healthy.
Somewhat buried cystic tonsils.

Slight flushing of the pillars.

Naso-pharynx:- Small greyish polyp above rt. middle turbinate.

Larynx clear.

Membranae-tymp.: - Retracted.

Antrostomy opening - widely patent.

Antroscopy:- Inf. meatus too narrow for antroscopy.

X-Ray Sinuses:- Degree of opacity of Rt. frontal sinus, ethmoid, and antrum.

Case 9.

Case 9 Mrs J.D.

First seen 21/6/40. Aet 29. Domestic servant.

History when first seen:-

Complained of nasal obstruction for two months.

Thick nasal discharge in the morning.

Not very subject to colds.

Feeling^{of}/heaviness in the head.

No throat or ear trouble.

Ant. Rhinoscopy:- Polypi both sides - No view of interior of nose.

Naso-Pharynx:- Polypi not obstructing. Post pharynx healthy.

Membrana Tympani - Normal.

X-Ray Sinuses:- Opacity of both antra.

For double rad. antrum and polypi.

28/12/40. Double Rad. Antrum and Removal of Polypi:-

Rt. side:- Antrum full of polypi but no pus.

Small ant. turb. ~~turb.~~inotomy of inferior turbinate.

Lt. side:- Thickened mucosa and two polypi found in antrum.

Counter opening made.

Polypi removed from nose.

18/9/43 Seen again:- Much improved. Feels well. Fine airway.

No nasal or post nasal discharge except when having a cold.

No headaches now.

Case 9 (Continued)

Pain across face when having a cold or in a cold wind.

No numbness of gums.

Great improvement in energy followed after 1 year after operation.

Nose continued to discharge for two months after operation - then gradually cleared up.

Ant. Rhinoscopy:- Septum badly to right.

Left fossa almost completely filled with large polypi - leaving narrow airway along inferior turbinates.

Small polypi coming from rt. middle turbinate area.

No pus seen in nose.

Post. Rhinoscopy:- Teeth-fillings otherwise good.

Small buried tonsils not unhealthy.

Naso-Pharynx:-

Polypi not seen posteriorly.

No post. turbinal enlargement.

No abnormal secretion.

Larynx:- Normal.

Left Membrana Tympani :- Somewhat retracted.

Rt. " " :-

Antrostomy openings:- Both patent but narrowing.

Antroscopy:- Edges of openings thickened and contracting down. What can be seen of the mucosa of antra is thickened pale and shows multiple pale, slightly raised edges.

Case 19.

Case 19. J. McM.

First seen on 13/7/37. Aet 50. Mill-worker.

History when first seen:-

Complaining of nasal obstruction and post-nasal discharge for - 12 years.

Occasional frontal headache.

Subject to colds.

Pain right side of face at times.

No sore throats - No ear trouble.

Anter. Rhinoscopy:- Septum deviated to left with poor airways.

Lot of pus in^{Rt} middle meatus.

Enlarged right middle turbinate.

Post. Rhinoscopy:- Small tonsils.

Naso-pharynx:- Normal.

Membranae Tymp.:- Normal.

X-Ray Sinuses:- Pansinusitis.

3/9/37 - Rt. Radical Antrum Operation:-

Antrum contained a great deal of pus and thickened mucosa. Mucosa scraped. Counter opening made and Rt. Inf. turbinate trimmed.

* Left intranasal opening made. Antral mucosa felt slightly thickened.

2/11/43. Seen again:-

Still has thick nasal & post-nasal discharge.

No nasal obstruction now.

No headaches.

Less colds - though working in cl. fumes.

Case 19 (Continued).

Occasional numbness of right cheek.

No numbness of gums.

Marked general improvement after the operation
- starting one month afterwards.

Ant. Rhinoscopy:- Septum deviated to left.

Crusting in both middle meatus and in choanae.

Mucosal atrophy right side.

Old ant.turbinitomy both sides Inf. turbinate.

P.R.:- Upper and lower denture since 1932.

Small buried atrophic tonsils - not obviously
septic.

N.P. :- Crusting post naso-pharyngeal wall.

Larynx:- Mucosa thickened. Cords thickened.

L. Membrana tympani:- Wax.

Rt. " " :- Thickened and scarred.

Antrostomy openings:- Rt. contracted
from ant. - backwards

Left side - No opening.

Antroscopy:- Opening too small to enter end of
Naso - pharyngoscope.

Case 23.

Case 23. Miss M. McG.

First seen 12/10/37. Aet 16 yrs. Shop Assistant.

History when first seen:-

Lot of post-nasal discharge.

No headaches.

Subject to colds - and hoarseness.

Has a cough.

No sore throats.

No ear trouble.

Duration:- 1 year.

Anterior Rhinoscopy:-

Septum fairly straight.

Turbinate - Mucosal atrophy (Left)

Pus floor left fossa.

Post. Rhinoscopy:- Tonsils have been cut. (Both remnants left).

Naso-pharynx:- Clear.

Larynx:- Looks healthy.

Membranæ Tympan:- Normal.

X-Ray Chest:- Negative.

X-Ray Sinuses:- Opaque right antrum.

6/12/37. Right radical antrum operation:-

Antrum full of foul pus. Anterior turbinotomy performed on Inferior turbinate. A good opening was made into the nose.

9/12/37. The patient developed an acute left ear.

12/12/37. The drum ruptured.

11/11/43. Seen again.

No nasal discharge complained of, but had constantly thick post-nasal discharge in the morning.

Case 23 (Continued).

No nasal obstruction.

No headaches.

There was marked improvement of general health.

Patient has not had such frequent colds.

Patient is now a fully trained nurse.

The improvement started three months after operation.

Still complains of aching in the right cheek when having a cold.

She had numbness of the gums during first year after the operation.

A.R.:- Septum badly deviated to left; there is poor airway. Has large rt. middle turbinate.

Pus in rt. middle meatus.

Large old anterior turbinotomy of Rt.

Inferior turbinate.

P.R.:- Teeth good.

Somewhat enlarged pale tonsils with flushing of pillars of fauces.

Naso-pharynx:- Poor view obtained. Appears clear.

Larynx:- Clear.

L.M.T. Retracted.

R.M.T. Scarred. Post. retracted.

Antrostomy opening:- Patent.

Antroscopy:- Smooth pale somewhat thickened ^{antral} outlet.

Mucosa, was covered with slight pus.

Case 26.

Case 26. Mrs J.K.

First seen 6/6/39. Aet 53. Occupation - Miner.

History when first seen:- Complained of nasal obstruction especially on the left side off and on for the past six weeks.

Has had much nasal discharge and was very subject to colds.

Had headaches - at the back of the head.

Had dizzy turns on stooping and raising himself erect again.

Never complained of sore throats or ear trouble.

Ant. Rhin.:- Polypi seen on both sides.

Naso-pharynx:- Polypi both sides, with pus above polypi on right side.

Memb. Tymp.:- Indrawn.

X-Ray Sinuses:- Opacity of both antra.

18/7/39. Double Radical Antrum Operation:-

Left antrum fairly clear but mucosa was thickened.

Rt. Antrum full of polypi.

The usual counter opening was made and flaps cut.

Nasal polypi were removed.

Seen again:-

20/11/43:- Now there is no history of nasal obstruction.

Nasal discharge is only present when having a cold.

There is slight post-nasal discharge.

Patient complains of occipital headaches at no particular time. There is marked general improvement in health especially as to 'dizziness' patient

experienced previously. This cleared up in three months after the operation though he still had occasional 'dizziness' and 'bleeding' from the nose.

He complained of 'ache' - on right side of nose when having a cold. Had no 'ache' over cheeks: and no numbness of gums.

Ant. Rhinoscopy:- Septum is badly deviated to right with large spur on the left side.

Mucosal atrophy present on both sides.

Rt. middle turbinate is enlarged pale and hard. There is ^a large firm polypus coming from region of left Middle turbinate.

There is a good airway remaining.

Post. Rhin.:- Patient has upper and lower dentures.

The tonsils are small buried and cystic.

Naso-Pharynx*:- Clear. There is polypoid enlargement of left Middle Turbinate.

Larynx:- The arytenoids are thickened. Cords are thickened and dull.

Memb. Tym.:- Both are very retracted and dull.

Antrostomy Openings:- The right is contracted but patent. The antral mucosa being thick and soft.

Left opening is filled in by soft tissue - just the remaining depression can be felt.

Antroscopy:- Not possible due to above findings.

22/1/44:- Patient has been using menthol inhalations and Ephedrine drops for the past three weeks. He has less nasal obstruction but still thick nasal & post

Case 26 (Continued).

nasal discharge. He still complains of frontal and occipital headaches.

X-Ray Sinuses:- Post, ethmoidal and sphenoidal sinuses on left side opaque.

For removal of nasal polypi and ethmoidectomy.

Case 27.

Case 27. Mr T.R.

First seen 6/6/39. Aet. 35. Occupation- Blacksmith.

History when first seen:- The patient complained of nasal obstruction on the right side - duration one week.

He was not subject to colds or headaches.

He never complained of sore throat or ear trouble.

Ant. Rhin.:- Large polypus seen on right side.

No vision deeper in.

Post. Rhin. :- Tonsils were small and submerged.

Naso-Pharynx:- Large post. ends of inferior turbinates seen on right side.

Memb. Tymp. :- Both normal.

X-Ray Sinuses:- Fluid level present in both antra.

Rt. Radical Antrum Operation:-

The mucosa was reddened but no polypi or pus found. A good opening was made into the Inferior Meatus.

Ant. end of Rt. Inf. Turb. removed.

Polypi were removed from the nose.

Left Proof Puncture proved to be negative.

20/II/43. Seen again:- Patient complained of no nasal obstruction- Except on right side when having a cold.

Had slight post-nasal discharge.

Had no headaches.

There was "definite" improvement after operation. He felt stronger and had less colds. All this within three months.

Case 27(Continued).

Complained of numbness of rt. cheek when having a cold and also numbness of gum.

Ant. Rhin.:- Septum is deviated badly to left, giving poor airway and blocking view to right high up and posteriorly.

There is a spur low down on right.

Right middle turbinate is reddened. Pus is present on it, and in middle meatus.

Post. Rhin.:- Upper and lower dentures.

Tonsils are buried and septic.

Naso-pharynx:- There is slight muco pus on upper border of left choana.

The post end of rt. middle turbinate is enlarged.

Larynx:- Normal.

Left Memb. Tymp.:- There is reddening of attic region and along handle of malleus.

Rt. Memb. Tymp.:- This is scarred anteriorly.

Antrostomy Opening:- is widely patent.

Antroscopy:- Is not possible because of low spur on that side.

Case 29.

Case 29. Mrs W. McK.

First seen 8/10/38. Aet. 27. Occupation - Housewife.

History when first seen:-

Patient complained of discharge from right nostril when stooping - duration one month.

Had never complained of headaches, sore throats or ear trouble.

Ant. Rhin.:-

Septum was deviated slightly to right.

There was a little congestion on the right side.

No pus was seen on either side.

Post. Rhin.:- Tonsils were small.

Naso-pharynx:- Clear.

Memb. Tympan:- Normal.

X-Ray Sinuses:- Showed opacity of right antrum.

2/11/38. Rt. Radical Antrum Operation:-

Antrum was full of polypi.

4/12/43. Seen again:-

Patient has no nasal or post nasal discharge.

No headaches.

No loss of smell.

Has however neuralgia of right cheek when having a cold.

Has very few colds - only twice during the winter.

There was no great difference in health after the operation.

Her health had not been bad before the operation.

There was numbness of gums for a while after the operation, but has worn off now.

Case 29 (Continued)

Ant. Rhin.:- Septum deviated to left and somewhat to right high up and posteriorly.

Rather poor airway is present on left side.

Middle turbinate is rather reddened with a few adhesions between its ant.end and the septum.

(Had an attack of influenza last week).

Old Anterior Turbinotomy of Rt. inferior turbinate is present.

There is no abnormal secretion.

Post. Rhin.:- Upper dentures are present. Lower teeth are good.

Tonsils are small and buried.

There is intense flushing of the Pillars of the Fauces.

Naso-Pharynx:- Adenoid remnants are present, otherwise Naso-pharynx clear.

Larynx:- Flushing of cords is present.

L.M.T.:- Somewhat thickened.

R.M.T.:- Somewhat retracted.

Antrostomy opening:- is completely closed.

Case 31.

Case 31. Mr J.G.

First seen:- 15/12/38. Aet. 32. Occupation - Labourer.

History when first seen:-

Patient complained of asthmatic attacks for the last two years.

He was subject to colds.

Had no ear trouble.

Ant. Rhin.:- Septum was deviated slightly to left.

Mucosa was practically normal.

There was no abnormal secretion.

Post. Rhin.:- The tonsils were small submerged & septic.

Naso-Pharynx:- There was some enlargement of posterior ends of inferior turbinates.

Some adenoids were present.

Larynx:- A little superficial congestion present.

Otherwise normal.

L.M.T.:- Wax.

R.M.T. :- Wax. Drum appears normal.

X-Ray Sinuses:- Fluid level present in rt. antrum.

7/1/39. Right proof puncture - clear.

12/1/39. Seen in Ward 26.

Patient had temperature of 101°F., and was reported to have a swelling over rt. antrum.

Examination:- Showed antrum neither swollen nor tender. Patient has a cough.

Ant. Rhin.:- Some pus in rt. middle meatus.

27/1/39:- Right Radical Antrum Operation:-

Mucosa was polypoid. A nasal opening was made.

30/1/39:- There has been considerable swelling over

Case 31 (Continued)

the right antrum. Fomentations were applied.

Antral wash-out - produced mostly blood.

3/2/39. Patient feels better, but had aches and pains in all his limbs. There was a rise of temperature. Sod. salicyl. gr. x. t.i.d. prescribed.

5/2/39. Discharged from ward.

18/2/39. Practically no discharge found.

Ant. Rhin.:-Clear both sides of nose - air-way good.

Seen again:- 14"12/43.

Has been and still is suffering from asthma for last 10 years. Has a cough.

Has never had nasal discharge but has nasal obstruction during an attack with sneezing and watery discharge.

Had 'terrible' headaches before the operation over the top of the head accompanied by dizziness.

Asthma did not disappear after the operation. but became less severe with improvement in general health.

Although for a time after the operation attacks became more frequent.

Nasal obstruction during attacks became less marked as did also the sneezing and watery nasal discharge.

Has no headaches now, but has slight Post-Nasal discharge.

No neuralgia of cheek.

Had slight numbness of gums after the operation which has passed off now.

His sense of smell is good.

Case 31 (Continued).

Ant. Rhin.:- Septum is deviated to left with poor airway and to right above and posteriorly.

Pale red infer. turbinates which are not enlarged.

Slight mucoid discharge. Patient has a cold.

Rt. middle turbinate seen. Pale pink in colour.

Nothing abnormal seen in rt. middle meatus.

Post-Rhin.:- Teeth good.

Small, buried, firm septic & cystic tonsils seen.

Flushing of the pillars. The uvula is enlarged.

Naso-Pharynx:- There is a large central pad of adenoids (aet. 37) obscuring view of posterior edge of septum and post. ends of turbinates.

No abnormal secretion is present.

Larynx:- There is reddening and thickening of mucosa.

The cords are oedematous and reddened.

M.T.s.:- Hard wax was present. After syringing seen to be normal.

Antrostomy opening was closed.

Case 32.

Case 32. Mr J.G.

First seen 12/8/39. Aet 33. Occupation - Driver.

History when first seen:- Patient complained of deafness in right ear - duration 2 weeks.

He gave no history of antral pain or discharge.

He suffers from nasal catarrh and has occasional sore throats.

Ant. Rhin.:- No pus seen.

Post. Rhin.:- Tonsils are enlarged.

Naso-pharynx:- Normal.

L.M.T.:- Normal.

R.M.T.:- Pink "Catarrhal".

Weber's to right. Whispered voice. Rt. - 12'

On Valsalva's Inflation drum moved out quite perceptibly.

X-Ray of Sinuses:- Mucous membrane thickening of both antra with a polyp in the left.

17/8/39 Double Proof Puncture.

Rt. - Curdy pus found.

Left- Thick mucopus found.

25/9/39: Rt. Intranasal and L. Radical antrum operation.

Ant. ends both inferior turbs. removed.

Left antrum was found to be partially divided into two cavities by a large ridge in the floor and medial wall. It was obvious that it was this ridge which appeared in the X-ray to be a large polyp.

The post part of the cavity was much the larger of the two and from there some polypoid material was removed. Otherwise the antrum was fairly healthy.

Case 32 (Continued).

There was pus in upper margin of rt. choanal opening.
Old turbinotomy of Inf. turbinates present.

Post. Rhin:- Remaining teeth are good.

Tonsils are small and buried but not obviously septic.

There is a degree of dryness and thinness of post. pharyngeal wall.

Naso-pharynx:- Mucopus above left Eustachian cushion

Thick crusty mucopus over floor of rt. choana and corresponding lateral wall of nasopharynx.

There is no enlargement of post. ends of Inf. turbinates.

Larynx:- Cords are flushed.

L.M.T. ;:- Retracted.

R.M.T. :- Normal.

Antrostomy openings: both closed.

Case 36.

Case 36. Mrs J.H.

First seen 30/5/40. Aet. 26. At home.

History when first seen:- Patient had left upper molar tooth extracted two days previously. Tooth was displaced into the antrum.

The left cheek swelled up.

She complained of no nasal or post-nasal discharge.

Previous history:- Patient's tonsils and adenoids were removed in 1/4/36.

30/5/40:- 4 days after tooth extraction.

Left Radical Antrum operation:-

Antrum opened and foul smell perceived. Some necrotic alveolar margin was removed and a molar picked out of the antrum. A counter opening was made with the usual flap. Ant. end of Inf. turbinate removed.

11/6/40. Discharge.

21/12/43. Seen again:-

Patient complains of no nasal or post-nasal discharge.

Has no headaches.

Has numbness of left cheek when having a cold or in cold winds.

Ant. Rhin.:- Septum is rather badly deviated to right.

There is a wide left nasal cavity with mucosal atrophy.

Old Inf. turbinotomy present on left side.

No abnormal secretion seen.

Post. Rhin.:- Upper and lower dentures.

Very carious last lower molar present.

Left upper alveolus well healed.

Tonsils have been cut - though lower pole remains on

right side. This remnant is septic(& patient has had a recent attack of tonsillitis on that side).

Naso-pharynx:- Thick lymphoid band is lying above the rt. Eustachian cushion. Otherwise clear.

Larynx:- There is a degree of granular pharyngitis of laryngo-pharynx with an enlarged lingual tonsil.

Otherwise larynx is normal.

L.M.T.:- Wax.

R.M.T.:- Normal.

Antrostomy opening:- is widely patent.

Antroscopy:-

Beak of instrument could be inserted right into the antrum. The walls are pale pink.

On the roof a few pale ridges are present.

A clear tache of light is seen under the eye.

Case 37.

Case 37. Master J.S.

First seen 18/2/39. Aet. II At school.

History when first seen:- Patient complained of nasal obstruction for the past two years.

Has no headaches.

Is very subject to colds.

Has occasional sore throats.

No ear trouble.

Ant. Rhin.:-Rt. side of nose was full of polypi.

Post. Rhin.:- Tonsils were rather large.

M.T.s :- Were normal

27/12/40.

Ant. Rhin. :- Septum deviated to right below and to left high up.

Compensating hypertrophy of Lt. Inf. Turbinate

Rt. side of nose filled with polypi.

Post. Rhin.:- Tonsils septic. Pillars of Fauces flushed.

Naso- Pharynx:- Polypi seen posteriorly on rt. side.

Re X- Ray Sinuses:- Opacity of right antrum.

20/24I.

Right Radical Antrum Operation:-

A very large choanal polypus removed from the nose.

Antrum was full of pus and mucosa was polypoidal.

Counter opening was made and flap cut.

Ant. end of Inf. Turbinate removed.

5/3/4I. Nose clear and clean.

28/12/43. Seen again:-

Patient complains of no nasal or post- nasal discharge.

Case 37 (Continued).

No nasal obstruction.

No headaches.

Has good sense of smell.

Patient had no real post-operative difference in general health.

Has no 'ache' of cheeks or

Numbness of gums.

Ant. Rhin.:-

Septum deviated to left high up and posteriorly.

There is marked mucosal atrophy on the rt. side.

Left Inf. Turbinate is large pale red.

Rt. Inf. Turbinate is large and firm showing old Inf. Turbinotomy.

There is no abnormal secretion.

Post. Rhin.:- A carious left upper molar is present.

Tonsils are enlarged and septic.

There is granular poster. pharyngitis.

Naso-Pharynx:- is clear.

Larynx:- Clear.

M.T.s Rather retracted.

Antrostomy openings are quite patent.

Antroscopy:-

Antral mucosa is pale and finely nodular.

Case 44.

Case 44. Mrs M.B.

First seen 1942. Aet. 45.

History when first seen:-

Patient gave a history of nine years of nasal obstruction and discharge. She also had post-nasal discharge.

Complained of headaches both frontal and occipital.

Had no sense of smell and was Listless and dull.

Complained of bad rheumatism of ankles and wrists with swelling, pain and stiffness.

Has had a discharging left ear since childhood.

Rt. ear used to run but has cleared up some years ago.

Has had removal of polypi on two occasions.

Also removal of tonsils and adenoids.

2/4/42. Rt. Radical Antrum Operation performed.

History after operation:-

Patient still complains of nasal and post-nasal discharge.

Obstruction present on left side.

Headaches - are less frequent.

Colds - less often and less severe.

There is a marked improvement of general health, especially of her rheumatic condition. This is only very slight just now. The improvement started within 2 months.

Has aching of left cheek sometimes.

No numbness of gums.

There is still loss of sense of smell & some loss of taste.

Ant. Rhin.:-

Septum deviated to the left with a narrow airway.

Mucous polypi on both sides present from Ethmoidal region and filling up upper part of cavities.

Post. Rhin.:- Upper and lower dentures.

Tonsils have been cut but there is a remnant on right side.

Naso pharynx:- Polypi seen posteriorly.

Larynx:- Clear - Slight redness and oedema of cords.

R.M.T. :- Scarred.

L.M.T. :- Pus present. There is an appearance of a fleshy attic region with a large perforation, marginal, and posteriorly.

Antrostomy opening :- Widely patent Rt. Mucosa thick and soft.

X-Ray Sinuses:- Mucous memb. thickening of left antrum.

Frontal sinuses have loss of translucency.

Case 47.

Case 47. Mrs A.K.

First seen 6/3/40. Aet. 47. Occupation - Housewife.

History when first seen:-

Patient complains of nasal obstruction on right side off and on for past 3 years.

She has repeated colds.

Thick post-nasal discharge but is not subject to headaches.

Has no throat or ear trouble.

Had had sciatica for 8 years.

Ant. Rhin.:-

Polypus present on both sides.

Post. Rhin.:-

Tonsils small and submerged.

Naso-pharynx:-

Polypi can be seen posteriorly.

M.T.P.s. Normal.

X-Ray Sinuses:- Shows gross thickening of mucous membrane of both sinuses.

27/4/40. Rt. Radical Antrum Operation and Removal of nasal polypi.

Polypi removed from both sides of nose.

Antrum contained polypi and pus. An intranasal opening was made with partial removal of Inf.Turbinates.

23/12/43:- Large polyp in right middle meatus.

8/2/44:- Seen again:-

Patient has much less nasal obstruction.

Has Post-nasal discharge though much less than before.

Has no headaches but never complained of headaches.

Case 47 (Continued).

Has an occasional frontal headache in the morning which is quickly relieved by taking salts.

Has very few colds.

Had marked improvement in general health - sleeps better particularly - as soon as 1 month after operation.

Has no neuralgia of cheek.

Has no numbness of gum ^{and} but never had any.

Still bothered with sciatica - had it before operation for 8 years - operation made no difference.

Has Acne rosacea of face.

Ant. Rhin.:-

Septum is fairly straight.

Polypi are present on both sides from middle turbinate region - large on right side.

There is still a fair airway.

Pus is present in lower part of the cavities.

Polypi are streaked with mucopus.

Rt. Inf. turbinate somewhat large & reddened.

P.R. Upper and lower dentures.

Tonsils are small, buried, cystic and septic.

Naso-Pharynx:- Choanae clear.

No abnormal secretion is present.

Larynx:- Hypertrophy is present of lymphoid nodules on lower post. pharyngeal wall.

Larynx clear.

M.Ts.:- Dull and indrawn.

Antrostomy openings widely patent.

Antroscopy - shows antral mucosa thin smooth and dry.

Case 50.

Case 50. Mr G.K.

First seen 7/2/40. Aet. 30. Occupation - Tram driver.

History when first seen:-

Patient complained of nasal obstruction on right side for past 6-7 months.

Had much thick nasal discharge.

Had some headaches - i.e. pains between the eyes.

He was not subject to colds.

Has had no sore throat or ear trouble.

(Patient is off work just now with influenza).

Has a cough with sputum which is constantly present.

Ant. Rhin.:-

Septum is deviated to the right.

Large polypus is present on right side.

Left middle turbinate is also polypoidal.

Post-Rhin.:-

Naso-pharynx. There is a lot of pus present - On right side especially.

Polypi posteriorly on the right.

Memb. Tymp.:- Normal.

X-Ray Sinuses:- Pansinusitis.

9/4/40. Double Radical Antrum Operation and removal of Nasal Polypi:-

Nasal polypi removed.

Rt. antrum - Polypi and foul smelling pus present.

Lt. " - Numerous polypi.

Usual counter openings made and flaps cut.

10/2/44. Seen again.

Nasal obstruction recurred 1 year after operation and is present now.

Complains of nasal and post-nasal discharge.

Has no headache in the mornings,

Has bad taste in mouth in mornings.

Has very poor sense of smell.

Colds - Not frequent. Clearer in head.

General Health:-

Cough with sputum has lessened.

Has no neuralgia of cheek.

and no numbness of gums.

Ant. Rhinoscopy:-

Septum is deviated to left anteriorly, to the right higher up and posteriorly.

Large polypi coming down from both middle turbinate regions - streaked with mucopus.

Post. Rhinoscopy:- Patient has upper and lower dentures.

Somewhat enlarged firm tonsils with slight flushing of the pillars.

Nasopharynx:-

Mucopus is present and polypi seen posteriorly in choanae.

Larynx:- Clear.

Memb. Tympani:- Normal.

Antrostomy Openings - Widely patent and dry.

Antroscopy:- Mucosa quite smooth and thin.

Mrs J.P. Case 55.

First seen 8/6/42. Aet 51. Occupation - Housewife.

History when first seen:-

Patient complained of thick nasal discharge for over a month.

Had occasional frontal headaches.

Nasal obstruction.

But had no throat or ear trouble.

Ant. Rhin.:-

There was no local sinus tenderness. Mucosal atrophy was present on both sides. There was a lot of heavy crusting in left nostril.

Post. Rhin.:-

Lot of crusting present on posterior wall.

X-Ray Sinuses:- No opacity.

Left Proof Puncture:- Negative.

29/9/42. Left Radical Antrum operation:

Scar in bucco-labial fold and deficiency present in the bone. May have been due to previous operation (?): but no opening present into the nasal cavity.

Mucosa was paper thin, pale and atrophic. It was not removed.

Usual counter opening made.

Specimens were taken from mucosa of antrum and inferior ^{and} middle turbinates on left side.

Pathological report:- Tissue from antrum- Rare eosinophils.

Case 55 (Continued).

29/9/42. From middle & Inf. Turbinates in one area in each are numerous eosinophils.

The presence of a considerable proportion of eosinophils in some regions is sufficient to warrant a diagnosis of allergic rhinitis.

10/2/44. Seen again:-

Patient has no nasal obstruction. Has less crusty discharge. It comes away of its own accord now. The patient had previously to use douching to remove and crusts. Dryness of nose/throat much less now.

No headaches - Only occasionally over vertex.

Does not catch colds frequently.

Has had loss of sense of smell which has not returned.

General Health:- There is marked improvement. Much stronger. Has been taking thyreoid tablets since Sept. 1943 for overweight or myxoedema.

High colour, present in cheeks and across brow, left her after the operation and before taking the tablets.

Has aching of right cheek - in frosty weather.

Had no numbness of gum now or after operation.

Ant. Rhin.:- Septum deviated somewhat to right.

Marked atrophy on both sides.

Large reddened left middle turbinate.

Small thin reddened rt. " "

Both covered with brownish but moist crusts.

Case 55 (Continued)

Post. Rhin.:- Patient has dentures - both upper and lower.

Tonsils are small buried and septic.

There is/^adry thin ^amucosa present on post. pharyngeal wall, covered with flat layer of crusting.

Naso-Pharynx:- Roomy. Thin pus present in left choana.

Larynx:- Cords reddened, otherwise clear.

M.Ts. :- Flushed.

Antrostomy opening:- Closed down.

Case 57.

Case 57. Mrs A.D.

First seen: 13/3/42. Aet 34. Occupation - Housewife.

History when first seen:-

Patient complained of constant sneezing and thin watery discharge - duration 1 year.

Ant. Rhin.:- Septum was fairly straight.

Polypi were present on each side.

Mucosa was allergic.

Post Rhin.:-

Tonsils were small.

Naso-pharynx:- Clear.

M.Ts.:- Normal.

X-Ray Sinuses:-

Showed mucous membrane thickening of rt. antrum.

10/11/43 Double Radical Antrum Operation and Removal of Polypi.

Lot of polypi and necrotic ethmoidal bone was removed on both sides.

Left Proof puncture yielded thick mucopus.

Both antra, but especially the right, contained large polypi and cheesy-pus.

Specimen taken of nasal and antral mucosa.

Pathological report 16/11/43:

Mucous membrane of the two specimens shows a moderately well marked diffuse round-celled infiltration with fairly numerous eosinophils scattered throughout. Specimen that of a chronic inflammatory lesion and the local eosinophilia strongly indicates an allergic Rhinitis.

17/11/43. Antral washout. - Yielded a little mucopus.

30/11/43. Ant. Rhin.:- Muco-purulent discharge. Otherwise looking well. No polypoidal tags. Alkaline followed by oily nose spray.

11/1/44. Better nasal airway. Rt. side somewhat obstructed.

Better sense of smell.

Patient still complains of some nasal and post-nasal discharge - especially in the morning.

General Health is much improved. Has more energy.

Had no headaches.

No cold.

Patient complains of ^{ache} ~~numbness~~ of right cheek when she has a cold, and 'ache' of both cheeks in cold winds.

No numbness of gums.

Ant. Rhin.:- Muco-pus present on both sides. Has had a bad cold.

Naso-Pharynx:- Clear.

Seen Again:-

Good airway present.

Patient's sense of smell continues to improve.

She still has sneezing attacks though these are much less marked.

General health has also continued to improve.

Ant. Rhin.:-Septum somewhat deviated to left below and with spur & to right above.

Small polypoid tag left in the ethmoidal region.

Otherwise clear.

Case 57 (Continued)

Post. Rhin.:— Upper denture. Lower teeth -pyorrhoea.

Small flat buried septic tonsils.

Naso-Pharynx:— Slightly pale smooth enlargement of post. ends of Inf. Turbinates and somewhat reddened enlargement of post. ends of middle turbinates.

Larynx:— Pallor of mucosa.

Reddish fleshy shelf extending from ventricles on to outer margins of each cord.

M.T'S:— Retracted scarred with chalk patches.

Antrostomy openings:— Rt. quite wide.

and Antroscopy:— Left, adequately patent.

Antrum dry.

Case 65. Miss H.R.

First seen 17/8/43. Aet. 23. Occupation - Engineering.

History when first seen :-

Patient complained of nasal discharge - duration - 1 year.

Was subject to colds.

Her left ear becomes painful when she has a cold.

Has no throat trouble but is subject to sneezing attacks.

Ant. Rhin.:- Septal spur far back.

Pus present in left middle meatus and large polypus present on the left side.

Post. Rhin.:-

Naso-pharynx; polypus in right choana.

Lot of pus posteriorly.

Memb. Ts. :- Normal.

4/10/43. Double Radical Antrum Operation and Removal of Polypi.

Nasal polypi and necrotic ethmoidal bone removed on both sides. Diseased necrotic bone made up the bulk of both ethmoids, and the nasal walls of the sphenoidal sinuses, which were both opened up.

Both antra were filled with large thick polypi and the mucosa was polypoidal and thick tough and fibrous. Foetid thick pus was present.

Usual counter openings were made and flaps cut. Naso - antral walls were particularly thick, and hard, and necessitated the use of the gouge anteriorly in making the openings.

Case 65 (Continued)

General health continued to improve. ^{started} within a month after operation. Numbness in gum disappeared now. Aching of cheek present.

Ant. Rhin.:- Septum deviated somewhat to left.

Slight sticky mucopus on somewhat polypoidal remains of middle turbinates. Otherwise clear.

Post. Rhin.:-Teeth good.

Small buried tonsils present which are not obviously septic.

Naso-pharynx:- Slight mucoid secretion.

Adenoid remains were present.

Choanae clear.

No enlargement of posterior ends of inferior turbinates.

Larynx :- Normal.

M.Ts. :- Normal.

Antrostomy openings. Rt. Patent.

Left Closed.

Case 66. Miss F.G.

First seen 27/4/43. Aet. 21. Occupation - Munitions.

History when first seen:- Patient complains of nasal obstruction of several months duration.

Suffers from colds and headaches - across the forehead and across the eyes.

Sneezing attacks with thin watery discharge.

Ant. Rhin.:- Mucous membrane is very oedematous and pale with watery secretion.

Post. Rhin.:- Tonsils small.

Naso-pharynx:- Not a good view obtained.

M.Ts.:- Scarred.

Right proof puncture with lipoidal injection .

25/5/43:- X-Ray Sinus - Frontal sinus absent.

Mucous membrane thickened in both antra.

Rt. Proof Punct:- Negative.

8/9/43 Rt. Radical Antrum Operation:-

Left Proof Puncture - absolutely clear, and the lining membrane thin and smooth.

Rt. Antrum:- clear and the lining thin and smooth throughout except at the junction of the roof and medial wall where it was very slightly polypoidal. Specimen taken from this.

Roots of last molar tooth formed a marked projection into the floor of the sinus.

Specimen of mucosa from Rt. inf. turbinate taken. Both Inf. turbinates which were rather large were infracted outwards and nasal airway considerable increased.

The inf. turbinates may need cautery later.

Pathological Report:-

Small round-celled infiltration and congestion.
Local eosinophilia absent. Other signs of allergy not present. The picture is that of chronic inflammation.
5/10/44. Doing well. Better airway.

Ant. Rhin.:-

Turbinates pale. Thin secretion.
2/11/43. No sneezing attacks or watering from nose.

Ant. Rhin.:-

Good airway.
Rt. turbinate not enlarged.
12/2/44. Seen again:-

No nasal obstruction.
No nasal or post-nasal discharge.
Much less frequent colds.
No headaches.
Sneezing attacks have ceased altogether.

General Health:- Patient is still somewhat tired.

Appetite is better.
No further attacks of acidity nausea and vomiting which were present before operation.

'Aching' of rt. cheek when out in the cold.

There had been numbness of gum, but this has passed off now.

Ant. Rhin.:- Septum deviated somewhat to right.

Mucosal atrophy.

Middle turbinates clear. No sign of polyposis.

Case 66 (Continued)

No abnormal secretion whatever.

Inf. turbinates not enlarged.

Post. Rhin.:- Carious rt. upper molar.

Tonsils - somewhat enlarged and septic.

Naso-pharynx:- Clear:-

Post. ends slightly enlarged and pale.

Larynx:- Clear.

L.M.T.:- Normal.

R.M.T. :- Large posterior scar.

Antrostomy opening:- Opening narrowed but patent.

Antroscopy:- Antrum dry. Mucosa thin and smooth.